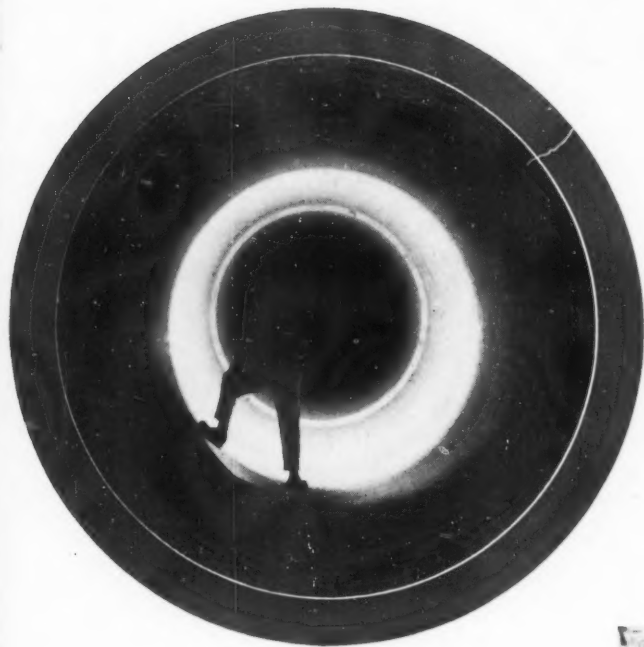


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Humboldt's

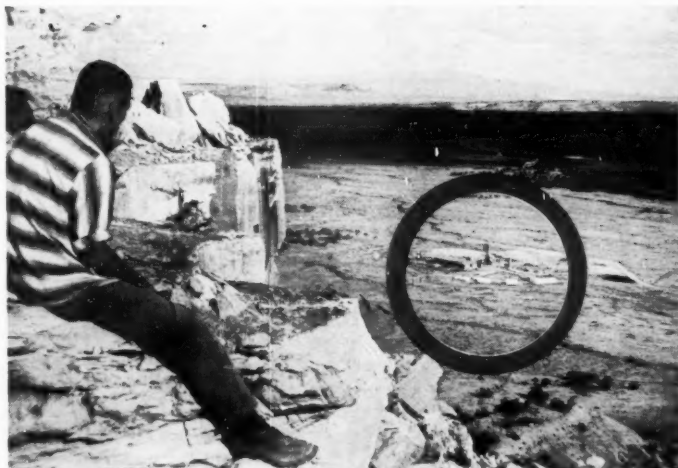
grate-kiln mill makes pellets from Michigan iron ore. An inside report by D. M. Urich

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Sabre-Pinon's

Black Jack U_3O_8 mine operations on Ambrosia's western trend. Special report by Richard Fitch

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British Columbia Boom sparked by Japanese iron and copper demand; 15 companies seek quick profits

► 28



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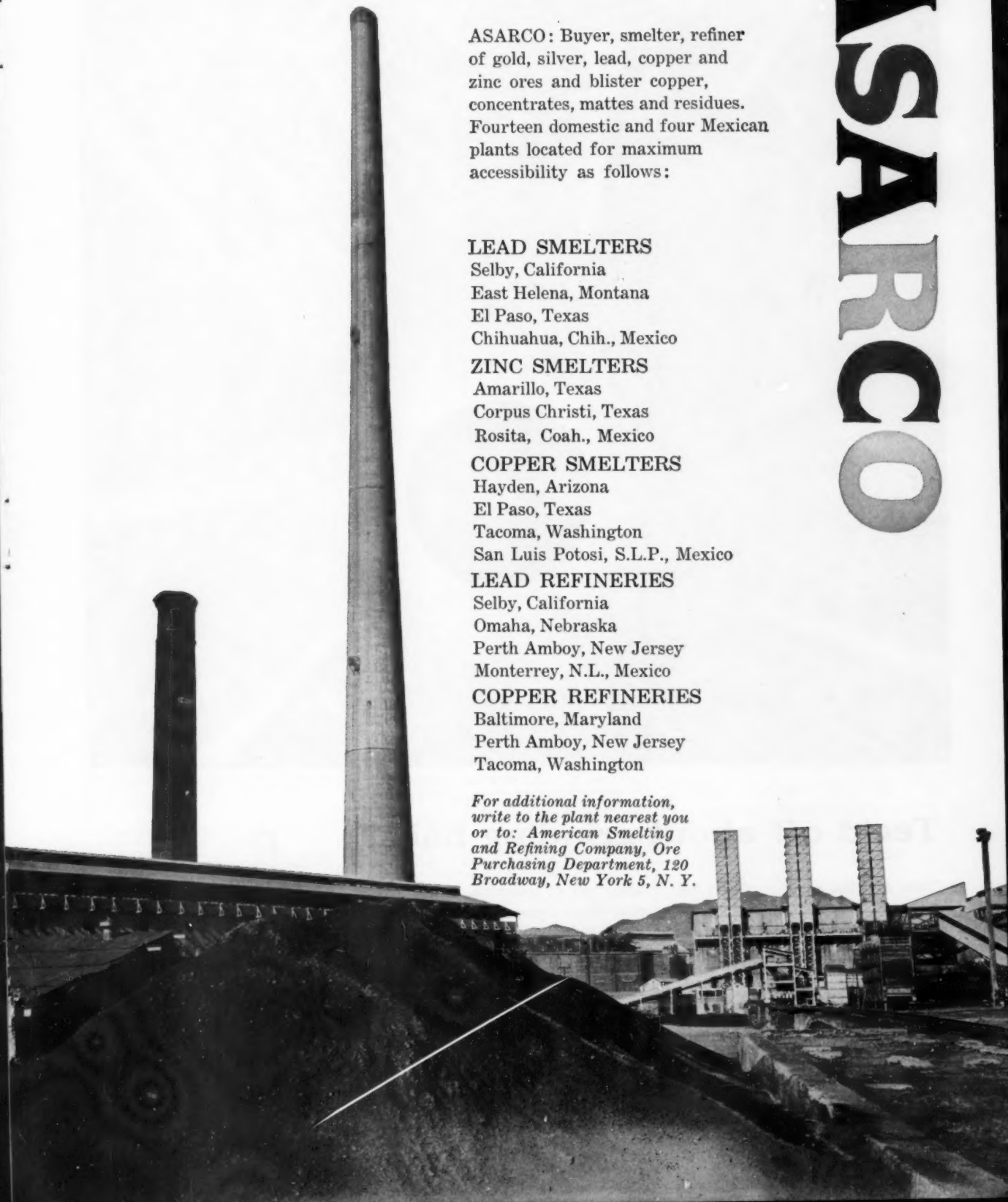
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Humboldt Mining Company's new mill in Michigan is now producing 2,000 long tons of high quality iron pellets per day using the new grate-kiln process. Here is an up-to-the-minute report on the revolutionary metallurgical process that has attracted the attention of the industry 16

Mineral Concentrates & Chemical Company, Inc. (Mincon) is using a new thermic-flotation process at its new mill in Colorado to produce a wide variety of high purity beryllium compounds and oxides 22

Lance Corporation's uranium mines in New Mexico are the subject of a detailed report that includes the geology of the ore bodies, as well as details of mining methods. The two mines, Black Jack No. 1 and No. 2, have differing problems relating to water and mining conditions 23

Mining Boom in British Columbia has been sparked by the insatiable demand of the growing Japanese economy for more raw materials. Signed contracts now cover more than \$200,000,000 worth of minerals to be delivered within the next few years 28

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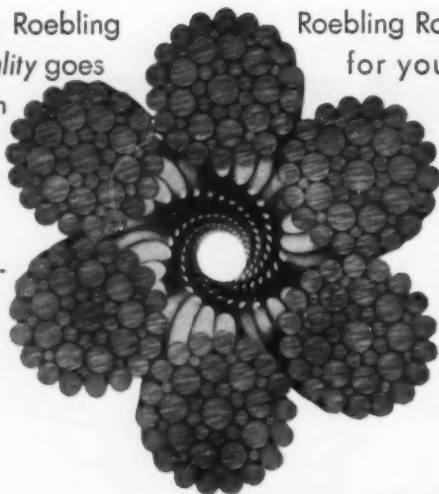
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Edmondson Lead-Zinc Bill Passed By House With Little Enthusiasm . . .

On Thursday, August 24, the House of Representatives passed H. R. 84, the Edmondson small lead-zinc mine subsidy bill as amended by the House Interior Committee, by a vote of 196 yeas, 172 nays, not voting 69. The bill as passed is a compromise between the original H. R. 84 and a suggested bill by the Interior Department. Its total cost will be \$16,500,000 over a period of five years. There was no strong opposition shown in the debate on the bill, nor was there any vast enthusiasm.

Representative Saylor of Pennsylvania proposed an amendment which would have reversed the formula in the bill and, instead of phasing out by reducing the eligible production each year, he would have started with 600 tons the first year and ended with 1,500 tons the last year, his theory being that it would take some time for certain mines to get into production and that after the fourth year they should be able to stand on their own feet. The amendment was defeated by voice vote. After which Mr. Saylor proposed to raise the

eligibility figure from 3,000 tons per year to 4,999. This amendment also was defeated by voice vote.

Those who spoke against the bill mostly were not against aiding the lead-zinc industry, but thought it should be aided by tariffs and quotas. Those who spoke for the bill obviously considered it an inadequate stop-gap, designed to placate the White House and using the Interior Department phase-out formula for this reason.

Typical comments, even of some of the bill's strongest proponents were to the effect that, "if we are to have legislation this year, this must be it." Representative Dominic of Colorado, a staunch friend of the mining industry remarked, "I recognize, and I hope the small miners will recognize, that this bill, if passed, will not revive good conditions and may prove a cruel hoax to those who rely on it."

Representative Saylor of Pennsylvania, who as mentioned above offered some amendments to H. R. 84 which were not adopted voted against the bill, remarking, "This bill

in my opinion, will do more harm than good; and I will tell you why. This bill is completely reversed in its philosophy. In other words, if you want to help the lead and zinc industry; if you want to do it by subsidies; if you want to take care of the mines that have been shut down, then you do not start out by making the maximum payment in the first year of operation . . . you should make the payment for the smallest amount in the first year and have the large amount in the last year."

Representative Ed Edmondson of Oklahoma, whose valiant work and persistence got the bill through the house, struck the keynote of the proponents when he said, "The only real difference on either side of the aisle is the approach that is to be taken to meet this need. I have been for a long time a firm believer in the old principle that a bird in the hand is worth any number of birds in the bush. Here is an opportunity for this hard-hit industry, which everyone agrees is hard hit, to get something in hand to help meet the need."

Senators Do Not Agree On Best Method To Handle Silver Situation . . .

It seems amazing how two groups of people can reach opposite conclusions from the same set of facts. Senator Church of Idaho and other Western Senators are busy trying to get the Treasury to stop selling "free" silver on the assumption that the price would then rise and improve the condition of the mines containing silver.

Senator Pastore and other Eastern Senators are pushing bills to repeal the Silver Purchase Act, which also would terminate Treasury sales at a fixed price under the assumption that on a free market the price would fall without the support price influencing silver sales, thus helping manufacturers.

Presumably both groups have available the same information.

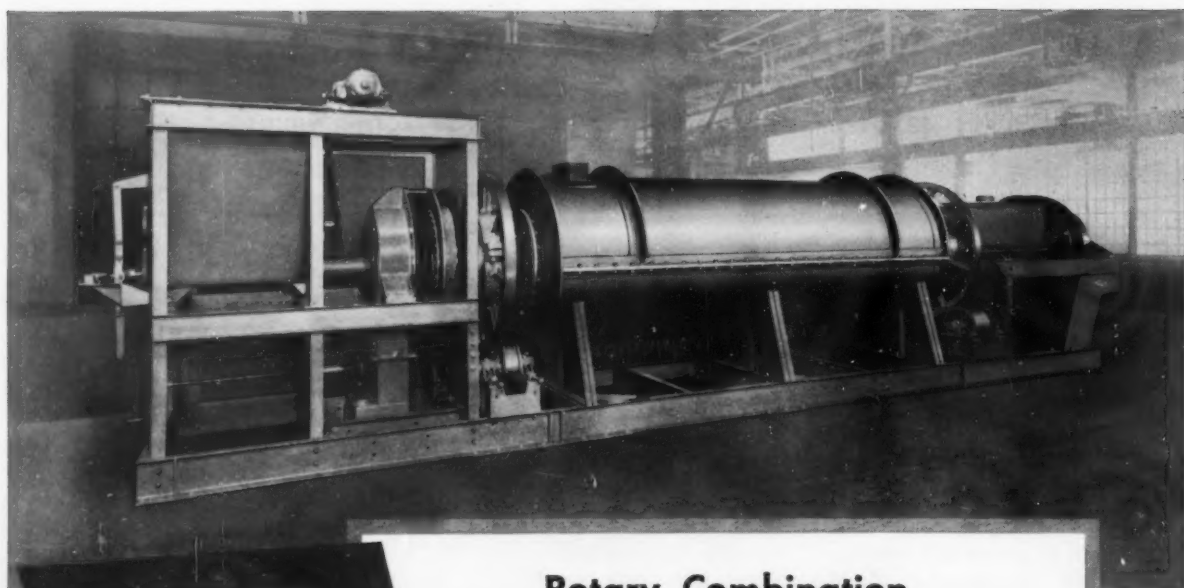
Senator Church has remarked, "(The Treasury) is subsidizing a small group of industrial users by selling them the Treasury's past accumulation of nonmonetized silver at the bargain price of 91 cents per ounce. . . ."

Senator Pastore says that the 91 cent selling price "in effect, provides a ceiling for the market price. . . ." "We have been deluged with impressive statistics and arguments that the price for silver in a free market will rise above its present level should the Treasury stop selling silver. Therefore there should be no hesitancy on the part of the producing interests in joining us in repeal of the silver purchase laws and permitting the market to seek its own level."

Of course the Pastore plan to re-

peal the entire Silver Purchase Act goes much further than the Church suggestion of merely stopping Treasury sales, as the legal purchase price of 90½ cents for domestic silver is in effect a support price. The rest of the authorization of the Act, that the Treasury shall purchase silver until the value of silver monetary stocks is equal to one quarter of the gold monetary stocks has never been carried out by any Secretary of the Treasury and, in effect is a dead letter. Nevertheless though the silver bullion transactions tax should be repealed the other parts of the Act should be left intact.

It still is a curious fact that both producing and consuming groups now want a free silver market, expecting to attain opposite results.



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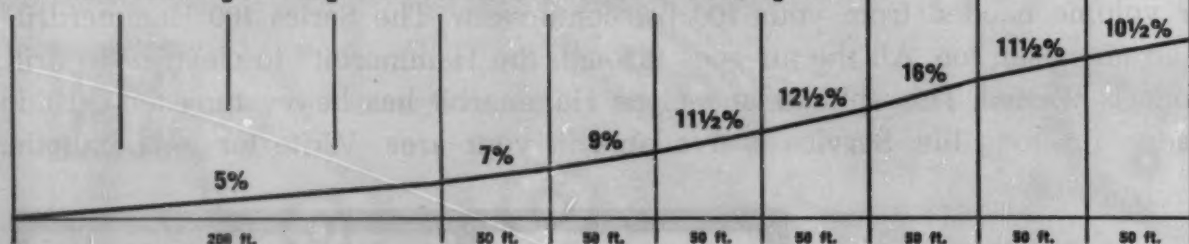
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The job: Stripping overburden for bauxite in Bauxite, Arkansas, for Dixie Contractors Inc., Memphis, Tenn.
Length of haul: 5400 feet one way, with the first 550 feet adverse grade.

CAT WHEEL TRACTORS IN STRIDE

This was no one-shot demonstration under favorable conditions. This was one of the many tough jobs where Caterpillar's Research Department placed 631s to field-test the production capabilities of these units. The results of this study particularly emphasize the value of Cat power shift on steep grades. But power shift pays off in other ways, too.

Matter of fact, it begins right in the cut. When the operator starts in load range, the scraper stays right with the pusher—doesn't pull away every time he raises the bowl to pump in a few more yards. When the scraper's packed full, he slips the shift lever into 1st range and steps on the accelerator. No spinning or bucking—it picks up the load right away. Depending on the grade, it shifts *automatically* up to direct drive ... and then *automatically* to overdrive ... or *automatically* down again as the steepness dictates. Topping the grade, the 631 quickly accelerates to hauling speeds, over 30 MPH.

That's because, unlike ordinary power shifts, the Caterpillar unit matches power *automatically* to job conditions. It gives you *three* types of drive—torque divider drive (25% of engine torque multiplied by the converter and 75% bypassing it), direct drive and overdrive—in each of three speed ranges.

In all, it provides nine different speed variations, but the operator need concern himself only with the three speed ranges and load range controlled by one lever.

Cat power shift—rugged yet simple

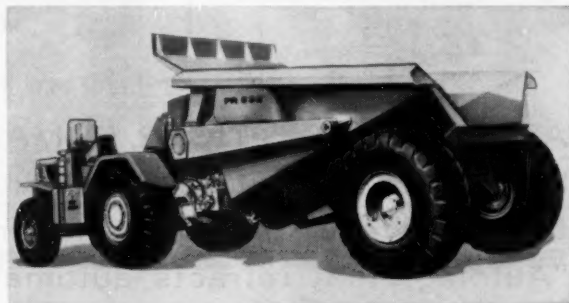
How rugged is the new Cat power shift transmission? Consider this. Although the concept for scrapers is new, much of the basic design is not. It's similar to the proven D8 and D9 power shift transmissions, which—over the past two years—have racked up thousands of hours of trouble-free operation. The main difference is in the arrangement of the exclusive torque divider, where a direct drive and overdrive arrangement have been added. Automatic shifting through these three types of drive is accomplished by a simple mechanical speed-sensing device and a hydraulic valve which actuates clutches. A shift indicator shows when to change speed range up or down as needed.

Full unit construction—easy servicing

Cat wheel Tractors give a smooth, stable ride ... and they're easy to service. They feature full unit construction. Every major component can be serviced without disturbing adjacent units. Two examples: (1) The torque divider transmission is removable without disturbing the engine. (2) The fan is mounted on the radiator shroud for removal as a unit.

Two power shift 420 HP models—the 631 and 630

Which is best for your job—the two-axle 631 or the three-axle 630? Both are powered by turbocharged, aftercooled 420 HP engines. The 631, carrying 28 cu. yd. heaped, has a high usable speed of 31 MPH. The 630 has a usable speed of 41 MPH and is available with two scrapers—capacities, 28 yd. and 35 yd. heaped. For complete information about the new 631 and 630, see your Caterpillar Dealer. Ask him to prove how they can step up your production and lower your costs! Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.



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Comparison of the Tiger, Puma and Lion

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Bore ins	3	2 3/4	2 3/4
Stroke ins	1 3/4	2 5/32	2 3/4

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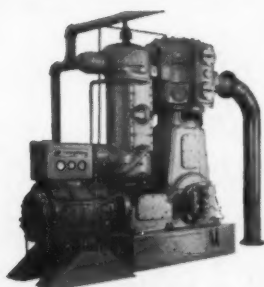
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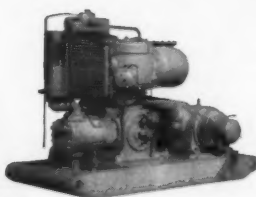
More air per horsepower than any comparable compressor! For continuous, full-load operation, "L" angle, 2-stage, double acting. Water cooled. Standard models provide 382 to 3210 cfm free-air delivery at 100 psi; only 76-590 hp required! (Can be supplied for other working pressures on request.)

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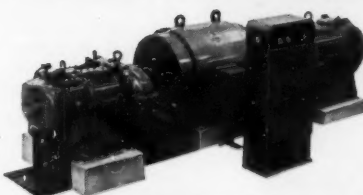
- (1) More air per horsepower—less power consumption than other comparable units!
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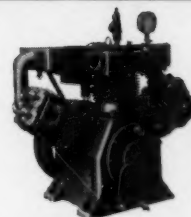
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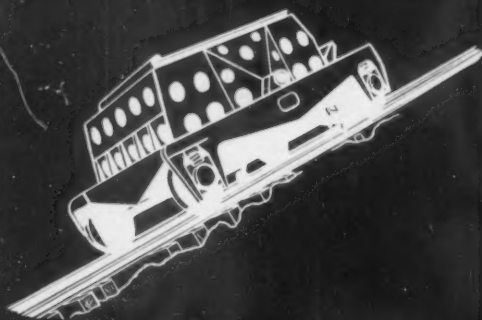
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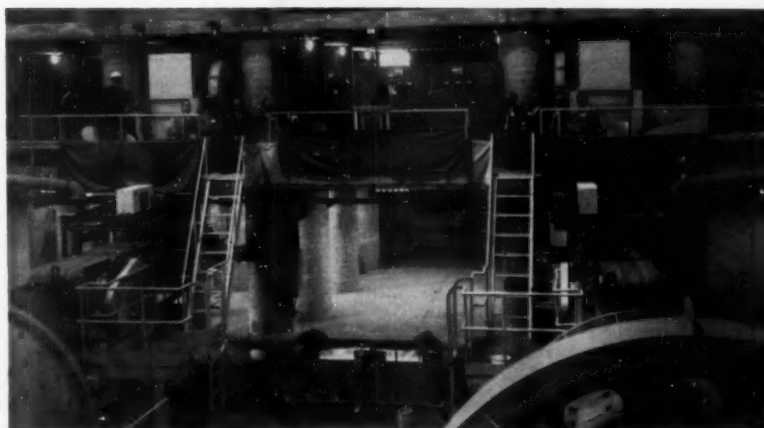
Canada's Craigmont Mine Starts Production

Craigmont — Canada's wonder mine—and British Columbia's largest open-pit copper mine, started full production on September 15th. This was just 52 months after Hole No. 3 hit ore.

The importance of Craigmont Mines Limited (N.P.L.) to British Columbia was outlined by deputy mines minister W. K. Kiernan as he said, "This mine creates a new industry to give a practical answer to unemployment." He paid tribute to the discoverers, the company directors, the consultants, and the financiers who had made Craigmont a mine. As he pressed the No. 2 rod mill starting button he said "We in British Columbia owe a debt to all of them."

And "all of them" were present: John D. Simpson, company president, who insisted on the newest and best equipment obtainable for the mine and mill; J. D. Gordon, vice president, who negotiated the very favorable sales contracts for concentrate and signed the Mine, Mill and Smelter Workers Union to an unprecedented four-year contract; N. H. McDiarmid, who steered the company through its rugged early days, and had the courage to drill that third (discovery) hole after two complete blanks; The discoverers—Franklin Price and Ron Renshaw—whose geochemical sampling indicated an ore body.

The financiers were represented by Vernon Taylor, Jr. of the United



CRAIGMONT MILL dedicated by Honorable W. K. Kiernan, British Columbia's deputy minister of mines, as he started No. 2 rod mill in 5,000 ton per day plant. Others on balcony are directors and management of the company.

States company—Peerless Oil and Gas—third largest stockholder, and E. H. Nash, Brown Brothers, Harriman and Company, which formed a banking syndicate to loan part of the \$18,000,000 needed to get the mine into production.

To the mining world, Craigmont's achievements can best be summarized by E. P. Chapman, Jr., of Craigmont's consulting engineers, Chapman, Wood and Griswold, Ltd., as follows: "Production has been achieved meeting time schedules announced earlier. The work has been completed within estimated costs and budgetary allowances."

Craigmont has diamond drilled 135,000 feet of holes, driven 10,000 feet of underground development, stripped 10,500,000 tons of waste, and mined 700,000 tons of ore. The top 9,000,000 tons of ore will be open pitted and the bottom 12,000,000 tons (as now known) will be mined underground. Grade is about 2.0 percent copper and 18 percent iron as magnetite and hematite. Craigmont ore did not crop out. Oxides come to within 70 feet of surface; sulphides 200 feet.

Craigmont shows what good prospecting, sound financing, and skilled management accomplish.

Hecla Leases New Park's Mayflower Mine; Will Build New Mill

Exploration and deep level development of New Park Mining Company's Mayflower mine in Utah's Park City district will be speeded under the terms of an agreement between Hecla Mining Company and New Park.

Hecla becomes operator of the mine and will build a 250-ton-per-day mill near the mine portal, primarily to treat the high gold-copper ore mined from the Pearl fissure. Undoubtedly the flow sheet will be easily adapted to treat the lead-silver-zinc-copper replacement ores mined from the Deseret limestone and dolomite.

Through 1960 New Park has mined 1,397,912 tons of ore with a gross smelter return of \$36,641,693. In 1960, 50,541 tons of ore were mined with a value of \$1,134,584 by lessees. New Park has never built a mill, however.

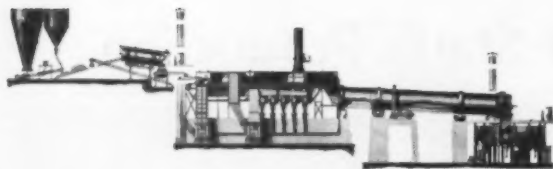
The Pearl fissure, while narrow and generally under three feet in width, has shown great lateral and vertical continuity with good walls and has always carried high gold values. Development on the bottom, or 2,005, level shows over one ounce of gold per ton in the fissure. The new mill, with a cyanide circuit, will

realize the greatest possible income from this ore.

New Park's deep level development program with the DMEA has located several high grade replacement ore bodies. Recent exploration in the Madison limestone opens possibilities for a new mine in this favorable horizon.

Hecla manages the Star, Lucky Friday, and Polaris-Silver Summit mines in the Coeur d'Alenes of Idaho and Radon uranium mine at Moab, Utah. It has a very capable engineering and managerial staff which will speed Mayflower development.

PELLETIZING Humboldt's iron



Humboldt Mining Company is now producing 2,000 long tons of high quality pellets per day at its recently enlarged and integrated Humboldt pellet plant.

Humboldt operates an open-pit mine, crushing and flotation plants, and the pelletizing plant which is described in this article. The operation of the mine and concentrator will be described in detail by R. W. Berkahn, operating metallurgist, in the November issue of MINING WORLD. The necessary step of regrinding the flotation concentrate to proper size for pelletizing is included in Mr. Berkahn's article.

The process combines three major pieces of equipment: 1. a chain type grate; 2. a rotary kiln; and 3. a counter current flow annular cooler. The gas and material flows through the system are utilized to achieve a maximum amount of heat transfer and to produce a hard, homogeneous iron ore pellet at relatively low heat inputs.

Allis-Chalmers Manufacturing Company, The Arthur G. McKee Company, and The Cleveland-Cliffs Iron

by D. M. Urich,

Metallurgist, Humboldt Mining Company

Mr. Urich graduated from the Michigan College of Mining & Technology in 1952, with a B.S. degree in metallurgical engineering. After two years service with the U. S. Army, he joined Dow Chemical Company as research metallurgist, and then in 1955 was employed as research engineer with the Jones & Laughlin Steel Corporation. In 1957 he joined Cleveland Cliffs Iron Company as a research metallurgist working in pelletizing and sintering; was transferred to the Humboldt pellet plant in April 1960.

Company first investigated the process using hematite flotation concentrates during 1957. This first work was conducted at the Carrollville pilot plant of the Allis-Chalmers Manufacturing Company.

Construction of the Humboldt pelletizing facilities began in the spring of 1959, and was completed in mid-1960. The Arthur G. McKee Company, Cleveland, Ohio, designed and constructed the plant, utilizing the major pieces of equipment supplied by Allis-Chalmers.

Raw materials: The required concentrate is conveyed into the pellet plant on a 24-inch wide conveyor from the mill and drops onto a reversible shuttle belt feeding any one of four surge bins. Positioning of the dumping point is done by the regrind mill operator who watches bin-

Regrind concentrate and bentonite are mixed and balled in

Regrind concentrate is stored in four storage bins of 450-long-ton capacity. These bins are conical with an angle of about 70° on the walls. The bins empty into feeder hoppers with an adjustable gate and an operating mechanism for controlling the flow of material dropping from the table feeder. The bins are equipped with a vibrator to insure movement of material, but the vibrators are rarely used.

The table feeders are driven by a direct current motor-gear reducer drive train to provide adjustable feed rates. A belt scale mounted on the conveyor carrying material from the table feeders signals a controller which adjusts the table feeder speed and also drives a proportioning controller to regulate the amount of bentonite added to the regrind concentrate.

The bentonite falls onto the feed conveyor belt inside of a reel-type mixer. The mixer itself is totally enclosed in a rubber boot.

All conveyors within the balling circuit are 30 inches wide and are driven by motorized head pulleys. Conveyors feeding the balling circuit are also 30 inches wide, but are driven by conventional gear reducers and V-belts.

The balling drums are 9 feet in diameter by 30 feet long. The drums are driven by 60 horsepower direct current motors to give a drum speed between 8 and 16 revolutions per minute. The cutter bars within the drums are also driven by a direct current motor to give a cutter bar oscillation rate of from 15 to 60 strokes per minute.

The cutter bar teeth are of carbide insert construction.

The green pellets discharge from the balling drums over a spiral-slotted edge to uniformly distribute the wet balls onto the seed screens. These screens are of the four-bearing type and run at 950 revolutions per minute. The deck is fabricated from parallel stainless steel rods with a 3/8-inch opening between rods. The discharge end of the screen is cut diagonally to feed the receiving belt uniformly. The green pellets are reweighed on this belt and tonnages recorded on circular chart instruments.

The weighed green pellets are next fed to a reciprocating feed conveyor to assure an even, level bed across the grate. This reciprocating conveyor carriage is hydraulically actuated to give a wide variation in rate of traversing and also to allow changes in the reversing rate. A unique feature of this conveyor system is the differential rate of travel between the conveyor carriage and the conveyor belt—these speeds are adjusted to allow feeding of pellets on only the reverse stroke.

The green pellets next fall onto a wide (111-inch) conveyor which serves as a feeder for the pellet feed screen. The feed screens are 9 feet, 4 inches wide and are of the four-bearing type. The deck is also made from parallel stainless steel rods, but set at a 1/4-inch opening. This feeder screen conveys the plus-1/4-inch pellets onto the grate for initial drying and induration. The "fines," or minus-1/4-inch material, falls through the screen onto a 54-inch wide conveyor which diverts this fraction into a

concentrate by grate-kiln process

Part I of II

level sensing-lights for an indication of concentrate level. Both the feed conveyor and the shuttle belt are interlocked with zero speed switches to help prevent spillage due to belt stoppage. Annunciation of belt stoppage is automatic.

Bentonite is brought into the plant in covered-hopper railroad cars. These cars are spotted over a rubber boot which in turn directs the dry pulverulent bentonite into a Fuller-Kinyon screw-type pump. This screw-type pump forces the bentonite into a stream of low pressure (5 to 7 pound) air and this stream carries the bentonite-air mixture to four overhead storage bins of approximately 85 ton capacity. Air from these bentonite storage bins is filtered through one of two, bag-type, dust collectors prior to being exhausted to atmosphere. The low pressure air required for pneumatic transport of the bentonite is supplied by a rotary compressor.

Control of, or positioning of feed points in the bentonite-limestone unloading system is done remotely at the railroad car dump point. Diverting valves, start-stop switches, and bin level indicating lights are located on one panel and require only part time attention.

In addition to the remote control station, all moving equipment can be stopped or controlled at the machine location. This double switch arrangement has proved of value in testing and allowing equipment to be "jogged" in place.

Pilot lights are provided at each remote control station to indicate running equipment and valve positioning.

drum to form green pellets

reclaim system. This reclaim system is described in more detail in a following paragraph.

A noteworthy feature of the material handling equipment up to the grate machine is the elimination of vertical drops of more than 12 inches. In every instance where green pellets are transferred from one conveyor to another, the pellets are dropped less than 12 inches to minimize pellet degradation and deformation.

All of the equipment in the balling circuit is controlled by switches on one of four balling drum control panels. Running lights are used to indicate moving equipment, while an annunciator system is used to signal equipment stoppage. Balling drum and cutter bar speeds are indicated but not recorded. Concentrate and bentonite feed rates are indicated and recorded. The green ball output is indicated, recorded, integrated, and resignaled to the kiln control panel. Concentrate, limestone, and bentonite, low-level lights are also mounted in these balling drum control panels.

The balling circuit consists of four separate balling drums. These drums are paired to feed one grate machine. The output from one set of drums cannot be switched to the other pelletizing unit. Flowsheet No. 1 shows the flow of material in the balling circuits and also the succeeding processing steps.

Turn page ►
for Heat Hardening Report

HUMBOLDT MINING COMPANY FACTS

Ownership: Jointly by Ford Motor Company and Cleveland-Cliffs Iron Company. Technical management by Cliffs.

Location: On Marquette Iron Range 14 miles west of Ishpeming, Michigan.

Ore: Low-grade mixture of cherty specular hematite and magnetite with minor martite and sericite.

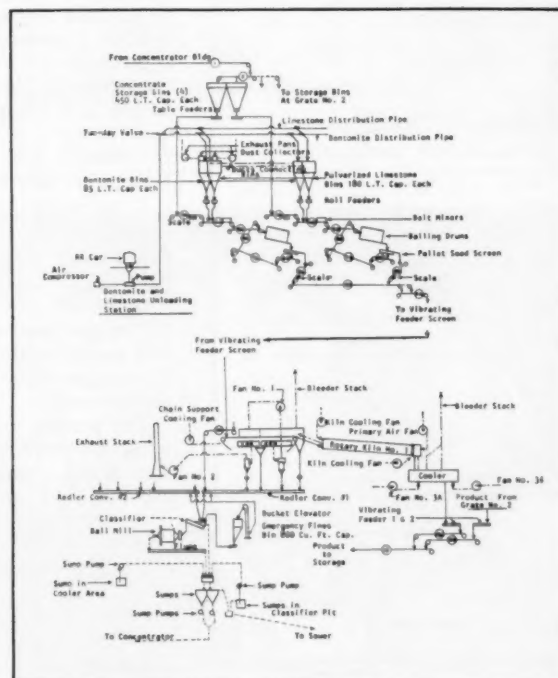
Mine: An open pit using jet piercing and rotary drilling. Five yard electric shovels load 40-ton Diesel trucks for short haul to crushing plant.

Crushing: Three stages—gyratory, and two cones.

Grinding: Three rod mills and two ball mills in circuit with hydrosclerator. Desliming in cyclones.

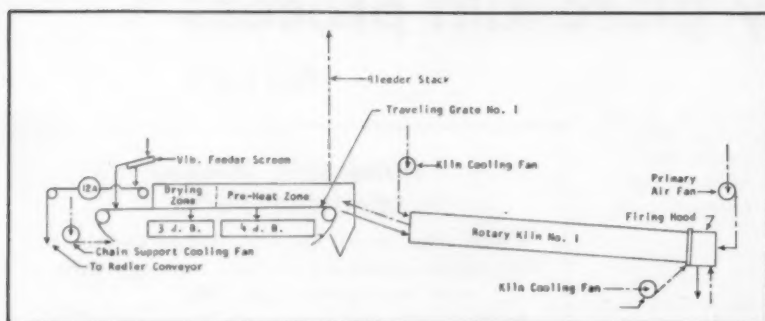
Flotation: Three stages in mechanical cells.

Regrind: Concentrate is reground to 75 to 80 percent minus-325-mesh for proper operation of pellet plant.

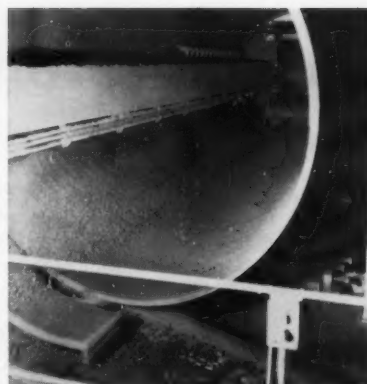


MATERIAL FLOW diagram through plant Flowsheet No. 1.

HUMBOLDT'S Grate-Kiln Plant



Pelletizing flow through elevated heat zone. Moving grate on left with rotating kiln on right. Plant has two sets of this equipment. **Diagram No. 3.**



BALLING DRUM with spiral discharge lip and vibrating seed screen.

Heat hardening of pellets is three step process to 1. dry and

This general classification will cover the heat hardening phase of the system. Three major pieces of equipment: 1. Chain type grate, 2.

Rotary kiln, and 3. Rotary annular cooler will be discussed. The Humboldt Plant has two identical units made up of these three components. The elevated temperature flowsheet is shown in Diagram No. 2.

Chain type grate machine is 71 feet long by 9 feet, 4 inches wide. Four strands of 10 inch Pitch chain pull the grate castings. There are 190 pitches per strand. In each pitch length there are nine grate castings, four chain cover castings, and two side castings. The total active area is 518 square feet of which 60 percent is in the preheat zone and 40 percent is in the drying zone. The bed of pellets upon this grate is normally maintained at a 7-inch depth. The grate speed is variable from 0 to 52 inches per minute and is driven by a 10 horsepower direct current motor.

Representative temperatures throughout the grate are as follows:

Preheat furnace	(Above bed)	1,750-2,000° F.
Preheat wind boxes	(Below bed)	600-700° F.
Drying furnace	(Above bed)	500-650° F.
Drying wind box	(Below bed)	180-250° F.

The gas flows in both the preheat and drying sections are down draft. The air handling system is covered in another section.

The preheat furnace is lined with a suspended tile form of construction. The drying furnace is lined with a multiple-layer type of troweled, steel-supported, plastic refractory. Both furnaces are backed with insulating block. The drying wind boxes are unlined, while the preheat wind boxes are lined with an abrasion resistant castable refractory.

A refractory lined stack is provided in the preheat furnace as a means of "dumping" heat in case of emergency

power failures or other unscheduled breakdowns. A motorized cap on top of this stack effectively seals this stack when the stack is not required.

Hot pellets are stripped from the discharge end of the grate by horizontal, stainless steel, stripper castings. These castings are held down by means of long, spring loaded rods protruding through the discharge end assembly of the grate.

The hot pellets are next directed through a "ski-jump" type of chute (refractory lined) into the kiln.

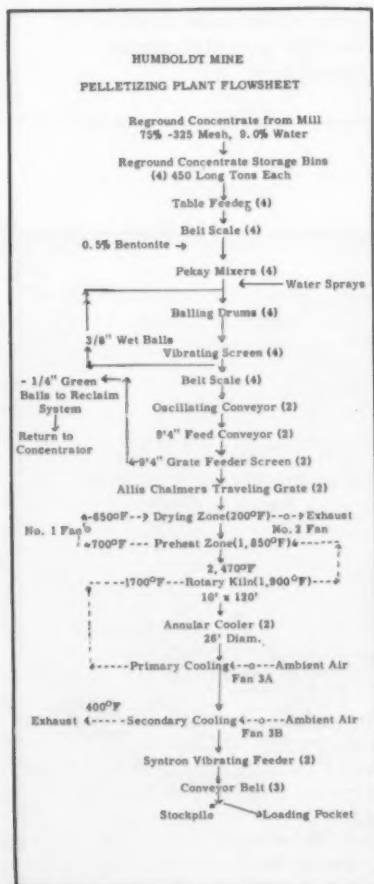
Rotary kilns are 10 feet in diameter by 120 feet long. Each kiln is driven by a 100 horsepower direct current motor and the speed is variable up to 120 revolutions per minute. An auxiliary gasoline engine is provided to turn the kiln, very slowly, during periods of total power failure.

The hottest one half of the kiln is lined with a 9-inch block while the second half is lined with a 6-inch kiln block. All brick is super duty, Dry Press Firebrick.

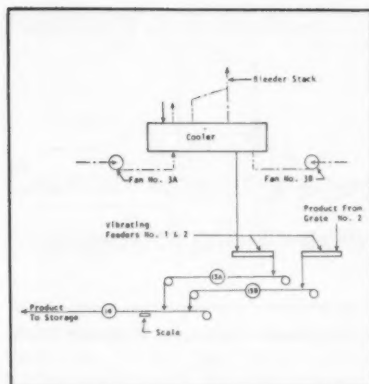
Both ends of the kiln are of double wall construction and are forced-air cooled.

The kilns are heated by one self-atomizing, No. 6—oil burner. These burners have a capacity of 500 gallons per hour of No. 6 oil at 230° F. and under 350 pounds per square inch pressure. Diagram No. 3 depicts the material flow through the system.

Rotary annular coolers have a mean diameter of 25 feet, 5 inches and turn at speeds of 0.4 to 2.3 revolutions per hour. The pallets upon which the pellets rest are 4 feet in width. The normal bed depth is 30-inches, automatically controlled by



ELEVATED temperature flowsheet for the plant. **Diagram No. 2.**



COOLING and pellet handling with air flow through cooler. **Diagram No. 4.**



PREHEAT FURNACE interior showing the travelling grate on the bottom. Opening in ceiling of refractory housing leads to by-pass stack. Man shows furnace size.

indurate, 2. fire for strength, and 3. cool and reclaim heat

a radiation emitting-sensing instrument. An auxiliary power unit is provided to turn the cooler in the event of total power failure.

The cooler serves two major useful purposes: 1. high temperature heat is recuperated from the indurated pellets and blown back into the kiln as secondary combustion air, and 2. the indurated pellets are cooled to a temperature approaching ambient. Rubber belting will transport the cooler discharged pellets with little danger to the conveyor belting.

The cooler is driven by a sprocket-chain assembly energized by two electric motors spaced 180° apart.

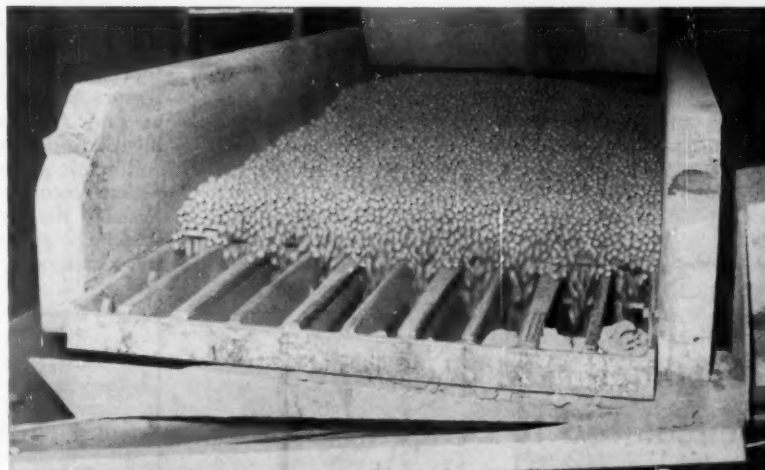
The moving section of the cooler is lined with a castable refractory while the stationary sections are lined with either a suspended tile or laid brick.

Pellets are conveyed from the discharge hopper of the cooler to the product handling belts by short vibrating feeders. These feeders prevent excessive surging and also serve to bypass any chunks. A series of conveyor belts carry the cool, finished pellets to either a loading pocket or to a stacking conveyor and thence to stockpile. Diagram No. 4 shows the material and air flow through the cooler.

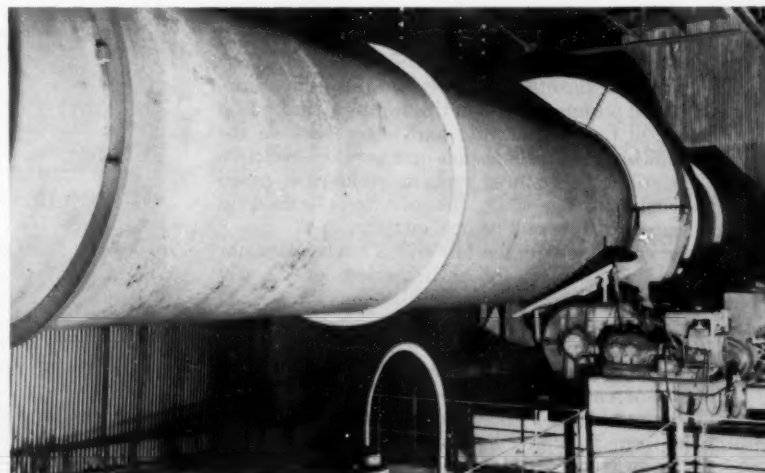
The Kiln control panel is actually a central station for all of the pressure taps, temperature sensors, thruput tonnages, and start-stop controls. Pressure indicators are of the pure mechanical type while the temperature instruments are both potentiometric and millivoltmeter types.

Turn page ►

for Dust Collection Details;
Operator Training Program



COOL PELLETS drop from the vibrating feeder onto the rubber product handling belt. Note the individual pellets, no clusters or fused chunks.



ROTARY KILN with 100 horsepower drive unit at right. This is one of two kilns each 10 feet in diameter and 120 feet long for hardening pellets.

Dust collection by cyclones; air circulation for cooling

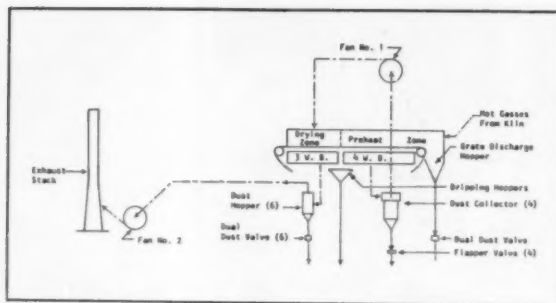
Grate fans (two) are identically constructed, but turn at different speeds. The preheat zone fan is driven by a 250 horsepower motor while the drying zone fan is driven by a 150 horsepower motor. The temperature of the gases through the No. 1 (preheat) fan is normally in the range of 600 to 700° F., while the No. 2 (drying) fan operates in a range of 180 to 250° F. Diagram No. 5 shows the air handling and dust collecting flow sheet within the grate portion of the system.

Diagram No. 2 pictorially presents the air flows through the grate section of the system. As seen in the diagram, dust collection for the gases coming out of the preheat wind boxes is provided by four "cyclone-type" collectors. These collectors are lined with an abrasion resistant castable refractory.

Gases to the No. 2 fan (air from drying wind boxes) are not cleaned. This moisture laden gas is directed to atmosphere through a 120-foot stack. Under conditions of normal operation, these stacks are dust free.

Kiln end and grate cooling fans are provided to keep both ends of the kiln cool and to cool the transverse members of the hot sections of the grate machine. Each is sized at about 2,600 cubic feet per minute.

Primary air fan (kiln burner). One fan on each unit provides the primary combustion air to each burner. Approximately 25 percent of the theoretical quantity of



AIR HANDLING and dust collection system. Diagram No. 5.

air required for combustion is supplied by these fans. Maximum pressure is 22 inches water gauge.

Primary cooling—pellet cooler—fan provides cooling air to one-half, or to four, wind boxes of the rotary-annular cooler. The volume is controlled by a master fan damper, and by individual dampers on each wind box. The fan is driven by a 100 horsepower motor. This air, after being preheated, is directed through the firing hood into the kiln for use as secondary combustion air. After passing through the bed of pellets, this air reaches a temperature of about 1,750° F.

Secondary cooling—pellet cooler—fan provides cooling air to the second half of the cooler or to the last four wind boxes. It is also driven by a 100 horsepower motor. A master fan damper is controlled by the kiln operator to allow varying the volume. Individual wind boxes are dampered by manual controls.

The air passing through the bed of partially cooled pellets (secondary cooling air) is heated to about 400° F. This air is exhausted to atmosphere by the cooler stack. The pellets are cooled to ambient temperature by this air prior to discharging.

Reclaimed dust and pellets recirculated to concentrator

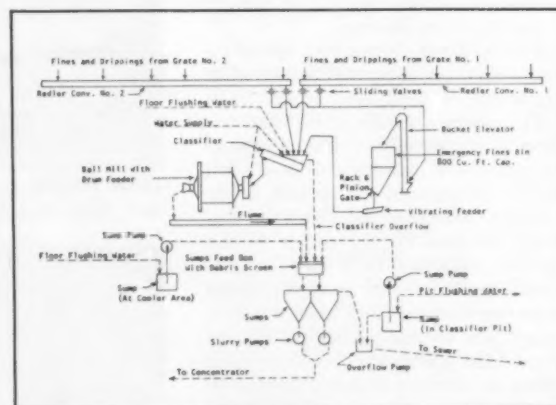
All of the grate drippings and cyclone solids are dropped into a drag-conveyor system by gravity. The dry, drag-conveyor drops the reclaimed material (dust and pellets) into a spiral type of wet classifier. Sands from this classifier are dropped into a small 3- by 3-foot ball mill (open circuit) and next sluiced into a sump. The overflow from the classifier also falls into this same sump.

Two vertical pumps operate in this sump pit and pump the mixture of fine concentrate and water back to the flotation mill for final reclamation in a series of cyclones.

The underflow from these reclaim cyclones is piped into the regrind mills while the overflow is used as "reuse" water in the mill water circuit.

An emergency fines storage bin and a bucket elevator are provided to take care of down periods of the wet section. A vibrating feeder empties the emergency fines bin as the reclaim section again becomes operable.

No. 6 oil is stored in a 420,000-gallon circular tank which allows about a 30-day supply. The oil is received in railroad tank cars, heated to about 120° F. for pumping, and transferred to this storage tank. The oil is withdrawn from the tank, heated to burning temperature by steam heated exchangers, and pumped through a closed loop system by positive displacement pumps. Operating line pressure in 350 pounds per square inch.



RECLAIMING system for solids and water. Diagram No. 6.

Steam is supplied by a 250 BHP boiler, producing steam at 50 pounds.

A 25-ton crane services the balling area and is adequate to lift all equipment within this area. Other plant areas are served by several monorail systems.

One four-man elevator services the balling area where a total vertical lift of 100 feet is required.

Both fresh water and "reuse" water into the pellet plant is strained or filtered in double compartment filters.

Power is brought into the plant at 2300 volts and distributed through two electrical control centers. All direct current power is generated at 230 volts.

Careful training program preceded plant operation

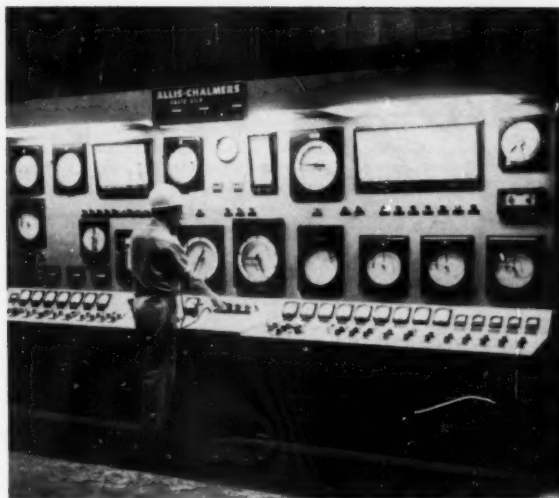
The key operators and leaders were brought into the plant during the latter phases of construction. These men were present for the running-in of the equipment by the contractors. Most of the initial starting of fans, motors, etc. was done in the evening when normal construction work had stopped.

These same men attended classes every day to learn the theory of operation as well as the recommended procedures of actual operation. These classes were taught by members of the Arthur G. McKee Company, Allis-Chalmers Manufacturing Company, and by The Cleveland-Cliffs Iron Company's supervisory personnel.

Some of the subjects covered were: 1. Equipment design; 2. Equipment operation; 3. Equipment limits; 4. Equipment lubrication; 5. Power distribution and interlocking; 6. Balling of materials; 7. Screen theory and operation; 8. Heat transfer within kilns and on grates; 9. Combustion; 10. Bentonite unloading; 11. Boiler operation; 12. Drag conveyor and dust value operation; 13. Theory of pellet induration; 14. Emergency procedures; 15. Safety; 16. Instrumentation theory; 17. Grate feeding; 18. Conveyor belt operation; 19. Flow-sheets; and 20. Product cooling.

The classroom lectures were supplemented by daily visits to the plant, as well as scheduled visits to operating plants utilizing all, or a part of, the equipment in the Humboldt plant.

Most of the men classified as Key operators were originally selected on the basis of (a) past work practices, (b) general intelligence tests, (c) aptitude tests, and (d) leadership evaluations. The selection methods were obviously good as these men have worked out very well, and have contributed in a large part to the success-



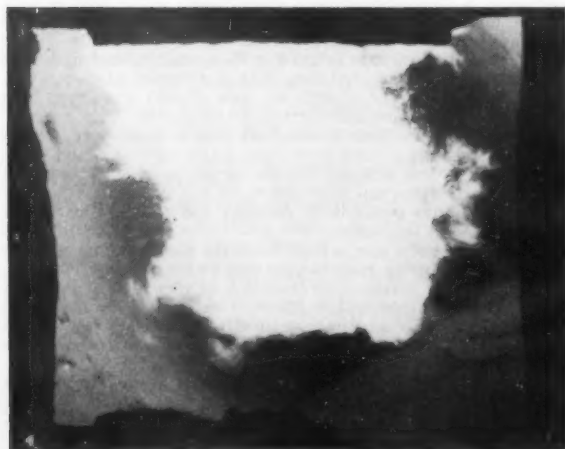
KILN CONTROL panel where most of data is recorded as well as indicated. Critical motor voltage and amperages are also indicated and red-lined.

ful start-up and operation of the Humboldt pellet plant.

One of the pelletizing units was started in early July, 1960, while the second unit was finished late in August, 1960. These separated starting dates meant the contractor's men were still on the job during the initial plant start-up and were available to correct most of the troublesome equipment. In addition, a large number of supervisory personnel were available to check and investigate faulty machinery.

Heat was supplied to the system very slowly—it took about three days to bring the system up to temperature. The resultant slow heating was beneficial as evidenced by a negligible amount of spalled refractory. This heating was first accomplished by spotting a number of propane burners throughout the cooler, kiln, and grate. The main kiln burner was used only sporadically during the second day of heating.

As the day neared to start up the second unit, additional operators were hired and trained-on-the-job.

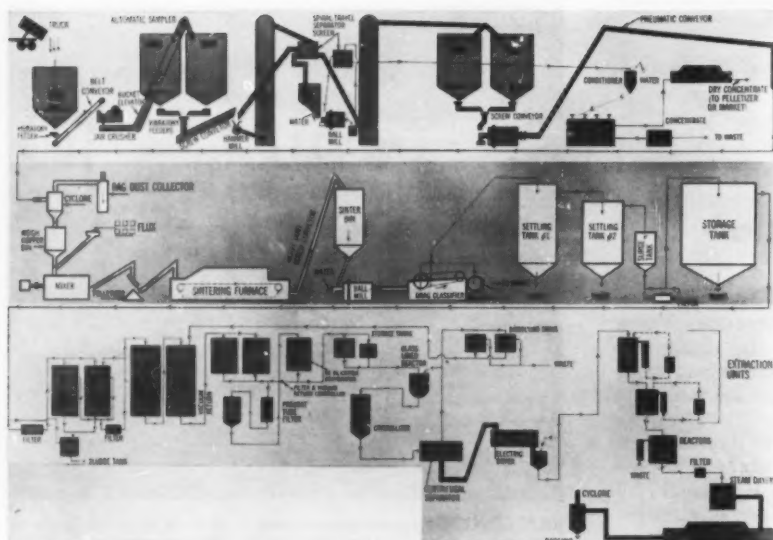


FLAME PATTERN within the kiln. The tumbling mass of pellets traveling through the kiln are visible at lower right.

Capacity within cost estimates

CONCLUSION

The Humboldt pellet plant has successfully proven the operability and pelletizing economics of Allis Chalmers' grate kiln system. A very high grade pellet is being produced at the designed capacity and cost estimates of the two-unit plant.



How Mincon Makes Beryllium Compounds From Colorado Ores

A new thermic-flotation process is now in use by Mineral Concentrates & Chemical Co. Inc. (Mincon) at its new mill in Loveland, Colorado to produce a wide variety of high purity beryllium compounds and oxides.

Mincon's major ore source has been the United States Beryllium Corporation's mines on Badger Flats, Colorado which were described in the March 1961 issue of MINING WORLD. The colored photograph reproduced on the March

cover showed the unusual ores being processed by Mincon. They are crystalline beryl, $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$; bertrandite, $\text{Be}_4(\text{OH})_2\text{Si}_8\text{O}_{22}$; and Euclase, BeAlSiO_3 . In addition, the company buys small lots of beryllium ore from individual miners at its Loveland, Colorado mill. The company's general manager, R. S. Myre, wants more ore, but he cautions prospectors and miners to be sure that their ore contains beryllium before they bring it to the mill. The

company uses a Boulder Scientific Company beryllium analyzer to assay all ore and control various steps in the mill circuit.

Ore as low grade as 1.0 percent BeO is being concentrated at the mill to a 18 to 20 percent grade. From either high grade ore or concentrate Mincon is now producing beryllium oxides with a 96.90 to 99.98 plus BeO content. A complete line of beryllium compounds are now available in commercial quantities.

FLOWSHEET LEGEND: Ore is unloaded from trucks directly into a 25-ton hopper and fed to a 6- by 12-inch Cedar Rapids jaw crusher via Synton and belt conveyor.

Bucket elevator sends crushed ore to automatic sampler and storage bins. Each bin holds a different grade and type of ore to assure proper blending for concentration.

The Jeffery hammer mill pulverizes ore to minus-100-mesh and either diverts to direct storage or through ball mill for flotation upgrading.

Ball mill grinds ore to minus-200-mesh. Pulp goes to special conditioning tanks and flotation cells for upgrading to 15 to 30 percent BeO.

Dry concentrate, or high grade ore, is ground to minus-320-mesh and are transferred through a pneumatic conveyor to storage bin No. 5 where it is weighed and fed to a mixing hopper.

Flux in the form of sodium carbonate and sodium fluoride are added at the mixing hopper.

Mixture is then fed to pelletizer where it is pelletized to approximately 1 inch diameter pellets and fed by conveyor to the sintering furnace which is a large Sunbeam conveyor belt type annealing furnace.

Pellets are fused in sintering furnace at a temperature of 1,750° to 1,800°F. depending on the ore. Ore from different deposits fuses at different temperatures and careful laboratory control must be maintained at all times.

As fused mass comes off cooling end of furnace it is fed to a heavy duty screw conveyor which acts as a primary crusher while conveying to storage bin.

Sinter is fed with a synton to a ball mill where water and peroxide are added. Also acid or caustic are added here to keep a very close control of pH to insure 100 percent extraction.

The slurry is fed to the drag classifier and solids are removed on a 3- by 5-foot Denver drum filter.

Pregnant liquor containing the beryllium plus large quantities of other impurities is pumped to a 5,000-gallon settling tank for further clearing. The top liquor is removed to a 4,000-gallon settling tank for additional clarification.

Pregnant liquor is pumped, via a surge tank, through a series of Sparkler plate and frame filters into the large 20,000-gallon storage tank.

Pregnant liquor, at this point, contains from 15 to 20 grams per liter of BeO plus approximately 1.5 percent iron, 2.5 silicon, 1.0 aluminum, 0.05 boron, 0.01 lithium, 0.1 phosphorous, 2.0

fluorine, 0.1 manganese, 0.1 magnesium, and comparatively large amounts of all other elements.

Pregnant liquor now begins its first and major purification step. It is pumped through a precote Process filter which removes all suspended particles of greater than 0.5 micron size. From the filter it goes into the two large oxidation tanks where high pressure air plus other chemicals are pumped into the bottom of the tank. By very careful control of the pH at different phases while heating the solution the greatest percent of the contaminants are floated off.

Purified pregnant liquor is then pumped to the primary precipitation tank where it is precipitated with caustic soda to a fine beryllium hydroxide. As this settles to the bottom it is pumped into the "wash" tank where it is scrubbed with water at a controlled pH to remove some of the remaining impurities.

The beryllium hydroxide is then pumped to the evaporators where it is concentrated to a thick paste. Nitric acid is then added to re-dissolve the beryllium hydroxide. By triple dehydration and filtration the silicon is removed.

The beryllium nitrate solution is then concentrated and crystallized in the special crystallizer that is designed to give a very fine crystal body. The crystals are then filtered and dried at a very low temperature and controlled atmosphere.

The crystals are then re-dissolved with a mixture of alcohol and organic acid.

Solution is then pumped into the liquid-liquid extraction unit where final purification takes place. At this point is formed the purest beryllium product—it contains less than 50 parts per million of total impurities.

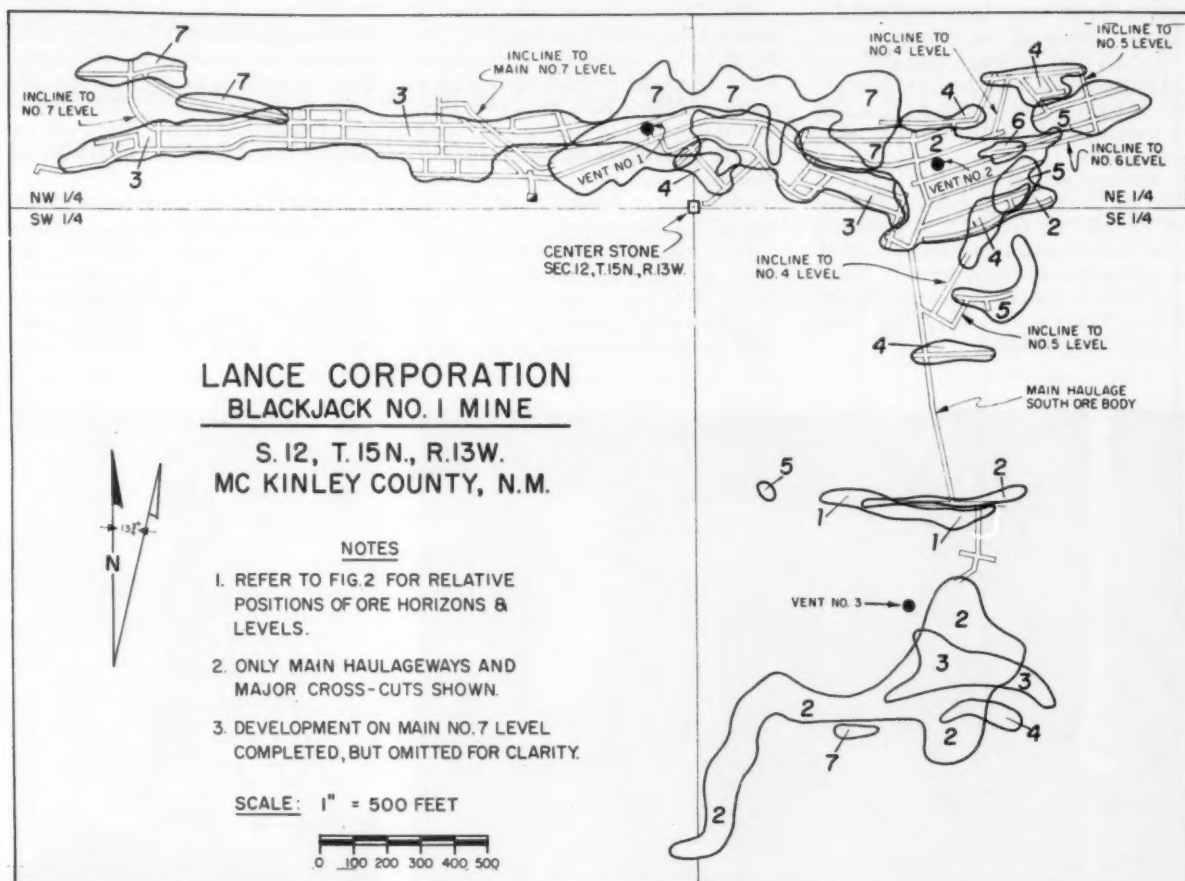
The beryllium is precipitated from the final solution by careful pH control using gaseous ammonia under pressure and heat.

The resulting beryllium hydroxide is of very high density and all particles are spherical in shape. This is then filtered in an Eimco filter and placed in a steam dryer. Proper drying of the hydroxide is as important to the final oxide as any step in the operation.

A standard Denver Fire Clay furnace that Mincon has rebuilt to its own specifications is used to calcine the oxide. If proper control is made on the solution and the hydroxide before calcining, the resultant oxide is of very uniform physical properties.

A special lined Spencer turbine vacuum system is used to pick up the oxide from the end of the furnace as calcination is complete.

END



Let's Look at Lance's Uranium Mines

by Richard Fitch

Through its Lance Division, Sabre-Pinon Corporation, the nation's largest independent uranium company, is currently producing ore from two mines in the Smith Lake area, McKinley County, New Mexico, about 20 airline miles northwest of the vast Ambrosia Lake uranium deposits (Figure No. 1).

The geology of the ore bodies is of interest, and the speed with which they were developed, coupled with efficient mining methods and an excellent safety record, have combined to put Lance in a strong position among the district's operators.

Ore was first discovered on the property in late August and early September, 1958, when a hole drilled near the west quarter-corner of Sec. 12, T. 15 N., R. 13 W., intersected 1.3 feet of 0.22 percent eU_3O_8 at a depth of 636 feet. This hole was drilled by Black Jack Corporation,

Mr. Fitch, geologist for Sabre-Pinon Corporation, was in charge of Lance Corporation's exploration program in the Smith Lake area before being transferred to Santa Fe, New Mexico as Sabre's home office geologist. He holds two degrees in geology; an A.B. from Cornell University and an A.M. from Indiana University.



whose leases were later acquired by Lance. News of the discovery was withheld and drilling suspended until negotiations with the New Mexico & Arizona Land Company for the acquisition of nearby leases were completed.

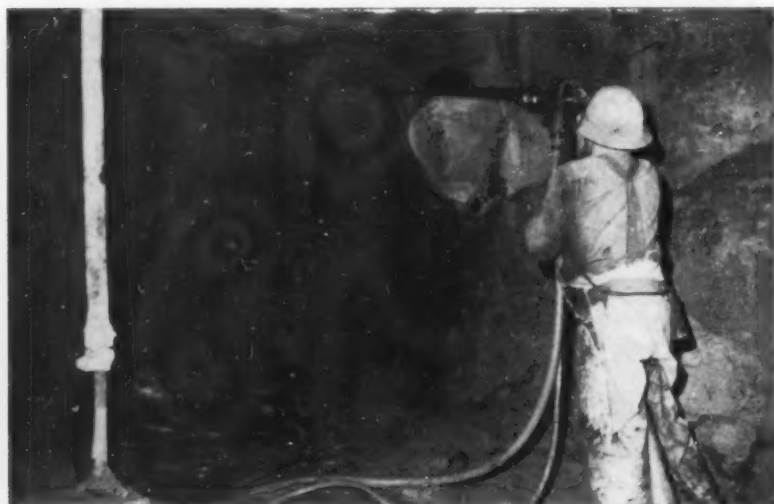
Drilling was resumed in December. By the end of January, 1959, 24 of 73 holes on Sec. 12 had encountered commercial mineralization, and a mineable ore body, termed Black Jack No. 1, containing some 375,000 tons of 0.30 percent eU_3O_8 had been roughly delineated.

On March 13, a little over a month later, drilling on Sec. 18, T.15 N., R.13 W., under the direction of Mike Mitchell, located what is now called the Black Jack No. 2 ore body. The discovery hole showed 18.3 feet of 0.92 percent eU_3O_8 . By the end of March, a total of 12 ore holes had blocked out a minimum of 25,000 tons of 0.56 percent eU_3O_8 .

With two ore bodies to its credit in three months, Lance received, in April, 1959, notice from the Bureau of Indian Affairs waiving further annual work requirements on its other

leases, totaling some 16,000 acres. This waiver enabled Lance to concentrate on thoroughly evaluating Secs. 12 and 18. As of December 31, 1960, 1,300,000 tons of 0.24 percent ore in place had been blocked out on Sec. 12 and 250,000 tons of 0.28 on Sec. 18.

Drilling has been contracted to the Clyde L. Jones Drilling Co. of Albuquerque and gamma, electric, and directional logging to Log-Master Services, Inc., of Enid, Oklahoma. Combined drilling and logging costs vary from \$0.71 to \$0.93 per foot.



DRILLING out face in the 8 Y South heading. Round breaks clean with accurately positioned holes. See safety stull and note roof bolting right up to face.



SKIP DUMPS directly into Euclid at No. 1. Note ladder to assist probing.

Black Jack 1 dry ore mined with off-track Diesel equipment

On February 11, 1959, less than two months after drilling on Sec. 12 was renewed, ground for the three-compartment (each 5 by 6 foot, finished) Black Jack No. 1 shaft was broken. In February, 23 feet were sunk with a crane and clamshell before the foundations for the collar and 65-foot headframe were poured. Final hoist and headframe installations were not completed until well into March. The hoist is a 225-horsepower double-drum Wellman-Seaver-Morgan, originally used at the Idaho-Maryland mine, Grass Valley, California, in 1910 and now somewhat modified.

Mechanized shaft sinking, employing a four-drill jumbo and a Cryderman mucker, got underway in April. During the three months ending June 30, 632 feet were sunk, an average of 8.1 feet per working day. Operations reached a peak in June when 315 feet of timbered shaft were

completed, or 12.1 feet per working day. Timbering was greatly facilitated by using the Lance Timber Cage (MINING WORLD, September, 1959, page 75), conceived by Bill Buchecker.

During July, August, and early September, shaft sinking was curtailed and work concentrated on the underground plant. A 60-foot, 12 by 15 foot station, 712 feet below the collar (was driven due north and the main east and west haulageways started.

A 5- by 7-foot slusher lane (later concreted), 30 feet directly below and parallel to the station, was finished, complete with rails set in a concrete floor. Two air-door-operated measuring pockets, feeding counterbalanced 72 cubic foot skips, were positioned flush with the south end of the slusher lane floor. A double-drum 25-horsepower Joy or 30-horsepower Vulcan are used in-

terchangeably for slushing.

Two ore passes, both raised to intersect the main haulageway near the north end of the station, feed the north end of the slusher lane. Number 1 raise still handles all ore on the main level. Number 2 raise was later extended upward by 45 feet to the main No. 7 level and a grizzly installed there. Its passage through the main level is concreted off and ore from the main No. 7 level now falls directly to the slusher lane, about 85 feet vertically.

Headings are drilled with Cleveland model 10HL jacklegs and blasted with Dupont Gelex No. 5. Sticks, 16- by 1 1/8-inch, are used for development headings and 26- by 1 1/8-inch sticks for pillar removal in retreat areas. Electric blasting caps are used throughout.

All development is trackless, using

continued on page 26

Ore localized on structural flanks, late ground water recirculation stacked layers

General: Almost all of Lance's property is overlain by Mancos shale of Upper Cretaceous age. Ore occurs within sandstone lenses (called Poison Canyon sandstone) in the lower part of the Brushy Basin shale and in the upper 90 to 100 feet of the Westwater Canyon sandstone, both of Morrison (Upper Jurassic) age (Figure No. 2). Depending on the target, drilling depths vary from 300 to 800 feet.

Regional dip is a gentle 2 to 3° to the northeast, except where influenced by the Mariano Lake anticline, the most important structural feature in the area (Figure No. 1). Important areas of mineralization discovered to date appear to be confined to the flanks of this anticline and to a smaller, but similar, flexure near the east boundary of the property.

Black Jack No. 1: Ore in this mine occurs in at least seven recognizable horizons within three more or less distinct sandstone units in the top 90 to 100 feet of the Westwater Canyon sandstone. Vertical distribution of ore is largely controlled by the influence of thin, but persistent, shales and spotty mudstone gall layers on earlier ground water circulation. Horizontal distribution is governed by gradual changes in porosity and composition too small to be detected with the naked eye.

Minor NE-SW post-ore faulting has resulted in displacements which vary from an inch up to at least the height of a drift in one instance. Later recirculation of ground waters along zones of faulting and fracturing is apparently responsible for areas of so-called "stacked" mineralization. This is particularly true in the east central portion of the ore body, where several surface drill holes penetrated as many as four or five of the seven ore horizons.

On the whole, though, ore horizons in No. 1 are remarkably persistent (the main horizon has been mined without a break for over 2,500 feet). Add to this the fact that it is one of the few completely dry, major, underground mines in the Ambrosia Lake area and the geologic picture becomes a very favorable one, indeed.

Black Jack No. 2: Ore in the No. 2 mine occurs in the lowest persistent sandstone member, called Poison

Canyon, of the Brushy Basin shale. Thickness of the sandstone unit varies widely, but best ore development seems to occur in the 25 to 35 foot range. The base of the Poison Canyon is about 100 to 120 feet below the base of the Dakota and 15 to 20 feet above the top of the Westwater which, while ore-bearing in Sec. 12, is brick-red and barren in Sec. 18.

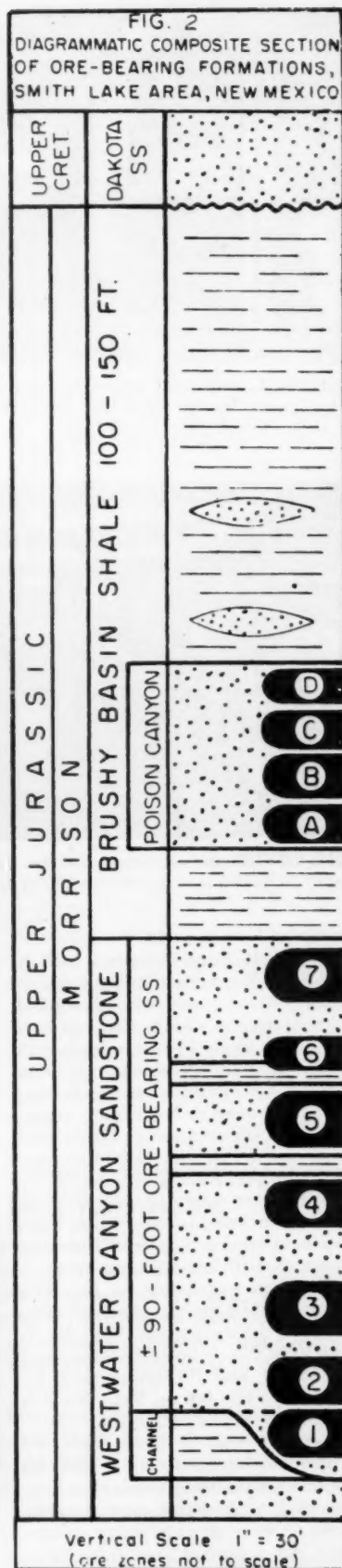
Extremely rapid horizontal variations in lithology and mineralization have necessitated surface drilling on 50-foot centers, which has been economically possible because of relatively shallow (270 to 385 feet) ore depths.



MAIN FAULT ZONE shown by geologist Marc MacRae. Note removal of mineralization by ground water along zone.



CONCENTRIC BANDING developed by successive pulses of ground water moving from left to right. Dark area is ore.

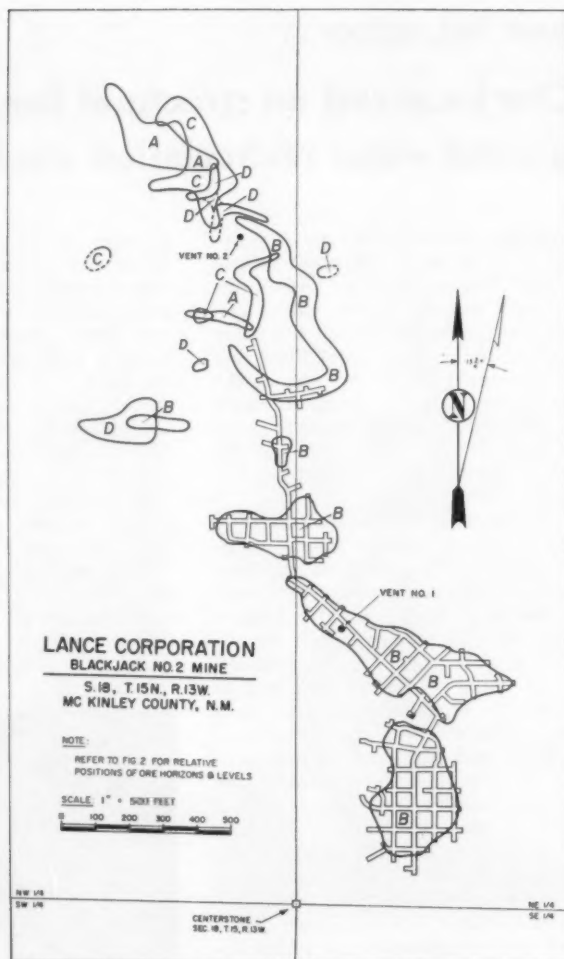




ELECTRICAL AND FIRST AID station, one of several which are strategically located throughout the mine.



WELL-LIGHTED station coated with fire resistant paint. Note excellent housekeeping characteristic of operation.



continued from page 24

one-yard Wagner front-end loaders and 9-ton Wagner and 5-ton Getman trucks, all equipped with air-cooled Diesel engines. Main haulageways are driven 7- by 14-feet, with higher backs at intersections to facilitate loading. Continuity of ore bodies has permitted more or less regular room-and-pillar development. Drifts and cross-cuts are driven on 60-foot centers, with pillar size averaging 45- by 48-feet. After upper levels are developed by inclines, transfer raises from the main level are driven. These are equipped with air-operated doors.

Excellent ventilation in No. 1 is maintained by four Joy Axivane fans. Those at the shaft collar, Vent No. 1, and Vent No. 2 are exhausting and are 65, 75, and 100 horsepower, respectively. The fan on Vent No. 3 is a 125 horsepower intake unit.

Vents 1 and 2 were cable-tool drilled and Vent 3 rotary drilled. All are lined with 36-inch casing and are provided with hoists and torpedo cages to serve as emergency escape-ways. Air is carried to working faces

through 20-in metal tubing. Developed areas scheduled for future pillar extraction are bratticed off.

Grade control at Lance is very closely maintained. All faces, regardless of their appearance, are probed before being loaded and blasted. Unlike chemically assayed channel samples, there is no time lag, and faces going into waste can be stopped immediately. All 2½-ton skip loads are probed when they reach the surface and, depending on grade, are allocated to various ore pads prior to shipping. Although individual shipments may be of widely varying grades, monthly averages have consistently held between 0.23 and 0.26 percent eU₃O₈. Rarely do mine and mill assays differ by more than 0.01.

Another feature at Black Jack No. 1 is its outstanding safety record—as of August 1, 1961, 30,109 manshifts, or nearly 14 months, without a lost-time accident. Probably the greatest single cause of serious injuries in the uranium mines of the Ambrosia Lake area is falling sandstone slabs. While workers are trained in special safety

classes and become eligible for bonuses following accident-free months, Lance's ground control program, which uses more roof bolts than any other district operator, is the most important factor in its low accident rate.

Roof mats on 30-inch centers are anchored by 6-foot long (minimum) roof bolts, also on 30-inch centers. In well fractured areas or where treacherous shale partings are present, sectional roof bolts are used in conjunction with steel drift sets. Control of backs over 10 feet high is supplemented by heavy wire mesh and ribs are secured with mats and 4-foot bolts.

Ingersoll-Rand No. 48 stopers are used for roof bolting. Bolts are tightened to a minimum torque of 180 pounds with an I-R impact wrench. During roof bolting operations, safety stulls and headboards are always used. Anyone found working ahead of the roof mats but without these precautions is automatically terminated.

During the fiscal year ending June

30, 1961, combined costs for all types of ground support averaged \$1.37 per dry ton of ore mined on Sec. 12 and \$1.62 per ton on Sec. 18. These figures represent approximately one-eighth of the total mining costs for each mine.

In the realm of cost reduction, Lance effects considerable savings, whenever possible, through volume purchasing. Equipment and materials quotations are strictly competi-

tive, with the result that Lance now spreads its orders among nearly 50 suppliers. Ingenuity, too, plays a role. Not long ago, dissatisfied with its ground support costs, Lance completely redesigned its roof mats and roof bolt washers. Substantial savings resulted, with no loss in performance. A hidden, but very real, plus factor in Lance's mining costs is the relatively low turnover in personnel. This is in large part due to good

working conditions, but also to an excellent company insurance program and other fringe benefits.

Once full-scale retreating begins, costs for longholing, roof bolting, air and water lines, ventilation, and surface exploration should be appreciably reduced. While blasting and slushing expenses may rise slightly, per ton mining costs should be lowered in the near future to about \$8.00 at No. 1 and \$10.00 at No. 2.

Mining and haulage complicated at No. 2 by water and underlying bentonitic shale

Black Jack No. 2 is essentially a scaled-down version of No. 1, with several important differences, as will be noted. The two-compartment shaft was started in August, 1959, and completed in February, 1960. A flow of water from the Dakota sandstone was encountered about 100 feet below the collar. A concrete ring, installed to catch this flow, serves a twofold purpose. It has effectively kept the lower part of the shaft dry and it now supplies domestic water for camp use at the rate of two to three gallons per minute.

The single-drum hoist is powered by a 211 horsepower Caterpillar Diesel engine. Underground installations are similar to No. 1, but designed to handle less tonnage. The station was cut at 280 feet and the slusher lane 30 feet below and parallel to it. Only one ore pass was raised from the slusher lane to the main haulage level. A 15-horsepower double-drum Joy slusher scrapes the ore into a single 2½-ton measuring pocket. At present, only one Wagner mucker and two 5-ton Getman trucks are used. Both vent holes are equipped with 65-horsepower Joy Axivanes and are exhausting. The shaft is downcast and is not equipped with a fan.

Mining conditions are more difficult at Black Jack No. 2 and differ from those at the No. 1 mine in two important features: (1) The ore-bearing sandstone at No. 2 makes a small, but steady, amount of water and (2) the ore sandstone is immediately underlain by a highly bentonitic green shale. These factors have combined to make maintenance of main haulageways a serious problem.

Dual wheels are standard equipment on all underground vehicles and at times operators have had to use chains (note increased Wagner and Getman costs in preceding table). These difficulties have now been

overcome, even in the worst spots, by building "bridges" of 16-foot, 8 by 10 inch timbers, strung lengthwise, covered by 3 by 12 inch planks laid crosswise. The mine now contains nearly 1,500 feet of artificial roadway, but the method has more than paid for itself by greatly reducing vehicle maintenance and haulage time and by allowing water to run down under the timbers into sumps formed by short cross-cuts off the main haulageways.

These sumps are periodically drained and mucked out to recover the high-grade fines carried in by the water. This practice has given rise to a system, perhaps unique in mining circles, which Al Ahartz, Black Jack No. 2 superintendent, refers to as "growing ore." It works this way: The No. 2 ore body (Figure No. 4) is composed of a series of isolated ore pods, separated by virtually barren ground. Whenever waste is mined while driving development headings between pods, it is spread on haulageways, thus covering the sticky green shale and providing a good road bed. As the high-grade fines are

recovered from the sumps, the wettest material naturally sloshes over the sides of the Getmans during transport. Instead of being irretrievably lost in the green shale, these water-borne values are absorbed by

Sabre-Pinon Corporation's Costs Per Dry Ton of Ore Mined for Fiscal Year Ended June 30, 1961

Operation or Category	B.J. No. 1 Sec. 12	B.J. No. 2 Sec. 18
Drilling	\$0.85	\$0.94
Blasting	0.80	0.82
Wagner loaders & trucks	0.74	1.03
Getmans	0.69	1.09
Grizzly	0.06	0.16
Slushing	0.14	0.27
Hoist	0.59	0.87
Surface loading	0.16	0.36
Roof bolting	1.37	1.62
Air & water lines	0.28	0.34
Ventilation	0.49	0.42
Underground elec. system	0.10	0.05
Longholing	0.13	0.12
Surface development		
drilling & logging	0.44	1.04
Mine general*	2.60	3.26
Other	0.38	0.28
Total	\$9.82	\$12.67

* Mine General account includes loading from stockpile, ore grade control, surface electrical system, engineering & mine geology, safety & health, employees' welfare, administrative costs, taxes, and other.

the barren road bed. By the time a new waste heading between ore pods is started, the old road bed is sufficiently enriched to run 0.15 to 0.17. It is then scooped up and hoisted as blending material, and the process is repeated.

About 4.0 Percent USA Yellowcake

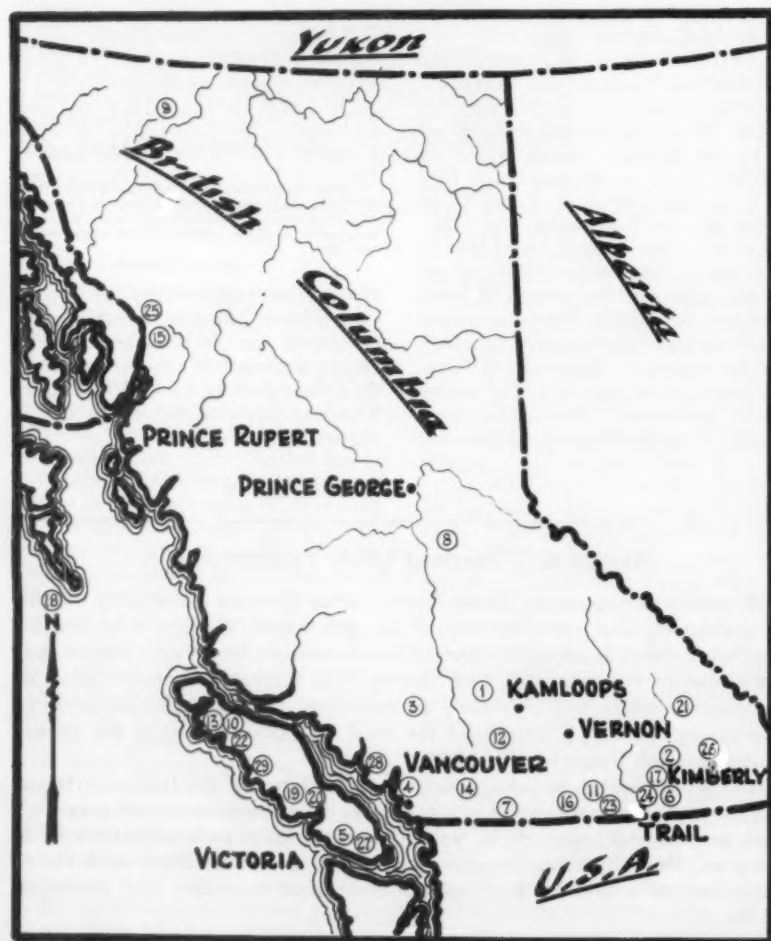
Between its two mines, Sabre-Pinon's Lance Division is currently mining and shipping about 20,000 tons of ore per month. The ore is hauled by the Sabre-Pinon Trucking Division to the Homestake-Sapin and Homestake-New Mexico Partners mills near Grants. It is estimated that the value of yellowcake which will ultimately be recovered from both mines currently represents nearly 4.0 percent of the total AEC commitment in the United States through December 31, 1966.

The writer wishes to acknowledge the assistance of the following Lance personnel in the preparation of this article: W. A. Buchecker, vice-president and general manager; H. D. Nelson, general mine superintendent; R. J. Lovgren, Black Jack No. 1 superintendent; A. J. Ahartz, Black Jack No. 2 superintendent; and M. E. MacRae, exploration manager and geologist at No. 1.

British Columbia Mining Boom

A realistic mineral policy plus Japanese need for raw materials are the two ingredients that equal BOOM in mining for British Columbia. Although mining booms have swept prosperity into the province before—the gold boom of the 1930's and the base metal boom of 1951—these never had the forward momentum of today's surge of activity. Records are being broken each year. Total mineral production of the province jumped from \$146,000,000 in 1958 to an estimated \$200,000,000 in 1961. Claim staking is 100 percent above the previous 10-year average, and leaped

from 13,459 in 1958 to an estimated 9,000 for only the first six months of 1961! The roster of mining companies active in exploration and development totals over 80 organizations, and covers the alphabet from "A" to "Z" (The Anaconda Company to Zeballos Iron Mines, Ltd.). Canadian, United States, Japanese, and British capital are all represented in various aspects of exploration, mining, and milling. From any viewpoint, this current expansion of mining activity and exploration in western Canada is big—and growing bigger as the months go by.



MINES TO WATCH IN BRITISH COLUMBIA...

1. Bethlehem	Cu
2. Bluebell (COMINCO)	Pb-Zn-Ag
3. Bralorne Pioneer	Au
4. Britannia	Cu-Zn
5. Bugaboo	Fe
6. Canadian Exploration	Pb-Zn-Ag
7. Canam	Cu
8. Cariboo Gold Quartz	Au
9. Cassiar	Asbestos
10. Coast Copper (COMINCO)	Cu
11. Consolidated Woodgreen	Cu
12. Craigmont	Cu
13. Empire Development	Fe
14. Giant Mascot	Ni-Cu
15. Granduc	Cu
16. Highland Copper	Ag-Cu
17. H. B. Mine (COMINCO)	Pb-Zn-Ag
18. Jedway Mines	Fe
19. Kennedy Lake (Noranda)	Fe
20. Maggie Lake (Noranda)	Fe
21. Mineral King	Pb-Zn-Ag
22. Nimpkish	Fe
23. Phoenix	Cu
24. Reeves MacDonald	Pb-Zn-Ag
25. Silbak Premier	Au
26. Sullivan (COMINCO)	Pb-Zn-Ag
27. Sunro (Cowichan Copper)	Cu
28. Texada Mines	Fe
29. Zeballos	Fe



TEXADA Mines, Ltd. has been shipping iron ore continuously since 1952.



EMPIRE Development still mines Merry Widow pit but reserves are dwindling.



ZEBALLOS Iron Mines, Ltd. is preparing to ship ore to Japan late in 1962.

Liberal Mining Laws, Plus Japanese Ore Purchases Spur Exploration and Development

One of the principal factors behind the current mining boom is the realistic legislation recently passed by the British Columbia government which established a satisfactory climate for risk capital. This has had the effect of stimulating exploration and development, so that 1959 mineral production valued at \$149,568,162 is expected to increase to \$250,000,000 by 1963.

The second principal factor behind the British Columbia mining boom is the insatiable demand of the growing Japanese economy for more raw materials. Japan possesses a wide variety of mineral resources, but reserves are small and few of them are able to supply even the nation's minimum need. As a result, vast tonnages of ores and concentrates are imported each year, including 90 percent of her iron ore requirements. From North and South America iron ore imports to Japan have grown as follows: 1950, 17,000 tons; 1955, 717,000 tons; 1959, 1,718,000 tons; and 1960, 2,824,000 tons! This fantastic upward trend will continue (though probably not as spectacularly) and British Columbia will certainly supply a major portion of these imports.

Japanese ore purchases in western Canada started when 113,535 tons of iron ore valued at \$790,000 was shipped from the Argonaut mine on Vancouver Island in 1951. That same year Texada Mines, Ltd. was formed to develop iron deposits on Texada Island, and first shipments were made

to Japan in 1952. Since then a total of over 6,500,000 tons has been shipped from coastal area magnetite deposits, including the record 1,040,563 tons shipped in 1960. Operating iron mines now include Texada Mines, Ltd., Empire Development Company, Ltd., and Nimpkish Iron Mines, Ltd., and in 1961 as a group they expect to ship about 1,300,000 tons . . . another record!

Iron Ore Leads Mining Activity

In the near future three more iron mines are expected to begin operations in British Columbia.

The Kennedy Lake mines, located near Ucluelet on Vancouver Island, are now being developed by Noranda Mines, Ltd. Operations are scheduled to begin in early 1962 at a rate of 700,000 tons of 61 percent iron concentrate per year, which will be shipped to eight Japanese steel companies under a seven-year contract.

Jedway Iron Mines, Ltd., a subsidiary of Granby Mining Company, Ltd., is now developing a large deposit on Moresby Island in the Queen Charlotte Islands. Operations are scheduled to begin in mid-1962 at a rate of 400,000 tons of concentrates per year. Sumitomo Shoji Company of Tokyo has a contract to buy 2,000,000 tons of concentrates.

Zeballos Iron Mines, Ltd., a subsidiary of the Takahashi-controlled International Iron Mines, Ltd., is developing the 4,000-ton Ford deposit near Zeballos on the west coast of

Vancouver Island. Construction is expected to start shortly on a 3,200-ton-per-day beneficiation plant, and concentrates should be going to Japan by mid-1962.

Several other iron deposits are known in the province, and will probably be brought into production during the next few years.

The Bugaboo Creek deposit, controlled by Noranda Mines and International Iron, is located near Port Renfrew on Vancouver Island. Reserves are estimated to be between 3,000,000 and 5,000,000 tons of ore, and tentative plans call for a 3,000-ton-per-day milling operation.

The Tasu Harbor deposit, now being diamond drilled by Ventures, Ltd., is on the Queen Charlotte Islands. This is the largest and richest iron deposit yet found in British Columbia, and one also containing commercial quantities of copper. Reserves are estimated to be 6,000,000 tons of iron ore, plus 1,000,000 tons of recoverable copper.

The Wedeen River deposit, also controlled by Ventures, is located on the mainland near Kitimat, and has estimated reserves of 1,000,000 tons.

The Iron River deposit, owned by Western Ferric Ores, Ltd., is located near Campbell River on Vancouver Island, and has reserves estimated at 600,000 tons.

British Columbian copper has also received Japanese attention. First provincial producer to sign an agreement with Japanese smelters was



HITACHI smelter of Nippon Mining Company, Ltd., 80 miles north of Tokyo, is one of the largest copper smelters in

Japan. To supply her growing economy, Japan must import about 45 percent of her copper requirements.

Cowichan Copper Company, Ltd., which shipped some 7,905 tons (contained copper) as concentrates from 1954 through 1960. This company is now developing the Sunro deposit on the west coast of Vancouver Island, and has a four-year sales contract with Mitsui & Company for all concentrate production at the world market price.

The largest copper producer now shipping to Japan is Craigmont Mines, Ltd. near Merritt, which has just recently completed its 4,000-ton-per-day mill and started production. Concentrates from this \$19,000,000 project will be sold to three Japanese smelting companies, and the American Smelting and Refining Company's smelter at Tacoma.

Another large British Columbia copper operation is the project of Bethlehem Copper Corporation, Ltd. near Ashcroft in the Highland Valley. Sumitomo Shoji Company of Tokyo has agreed to spend over \$5,500,000 to erect a mill with a minimum capacity of 3,000 tons a day, on the understanding they have the right to purchase the first 10 years' copper production. Operations are expected to start in December 1962, and the mill may be increased to 50,000 tons at a later date. Ore reserves are calculated for several ore bodies, one of which has 12,600,000 tons of 0.70 percent copper, and another 5,500,000 tons of 1.15 percent copper.

After remaining idle for some 40 years, the Coast Copper Company mine at Benson Lake at the north end of Vancouver Island is being brought into operation by Consolidated Mining & Smelting Company, Ltd. Mitsubishi International and Dowa Mining Company of Tokyo have contracted to buy 60,000,000

pounds of copper, worth about \$19,000,000, over a five-year period. A 750-ton-per-day mill is now being built, and shipments to Japan are scheduled to begin in the spring of 1962. Ore reserves are reported to be 2,000,000 tons averaging 2.5 percent copper.

Canam Copper Company, Ltd., in the Maunung Park area, is negotiating a contract with Mitsui & Company for financing construction of a 1,000-ton-per-day mill. Mitsui is reported to have made a verbal agreement to invest \$1,750,000, and Lorado Uranium Mines, Ltd., is willing to grant a \$500,000 loan for equipment and mill machinery.

Granduc Mines, Ltd. is exploring a large area of copper deposits in the Stewart district that reportedly have reserves of 25,600,000 tons averaging 1.62 percent copper. The Japanese have reportedly opened negotiations for the purchase of eventual production.

Japanese Interests Varied

In addition to copper and iron, Japanese interests have been purchasing the entire nickel production from the operations of Giant Mascot Mines, Ltd. near Hope. Cassiar Asbestos, Ltd., in northern British Columbia, is shipping increasing amounts of top quality fiber to Japan, and Ainsworth Base Metal Mines, Ltd. will soon be shipping lead-zinc concentrates from its Black Fox property near Kaslo.

Besides a continuing program of concentrate purchases, the next big step for the Japanese will undoubtedly be the establishment of plants and smelters to produce anode copper and sponge iron in British Columbia. With ample supplies of coal,

gas, and electricity, energy costs are substantially lower in western Canada than in Japan. Thus, it makes common sense to carry out processing operations in British Columbia rather than ship only concentrates. Development and encouragement of this idea was one of the big reasons behind the recent trip to Japan made by The Honorable W. K. Kiernan, Minister of Mines for British Columbia.

Although it may be the most spectacular, the Japanese market for raw materials does not account for all the momentum behind the current British Columbia mining activity.

On Vancouver Island, Kopan Developments, Ltd. is conducting an intense exploration program at the Big Interior copper prospect, and National Explorations, Ltd. has a diamond drilling program going at the New Privateer gold mine at Zeballos.

The Camp McKinney gold mine near Rock Creek has been reopened and is shipping important tonnages to the Trail smelter of Consolidated Mining & Smelting Company of Canada, Ltd. Near Wells, Cariboo Gold Quartz Mining Company, Ltd. has developed a new ore body of substantial tonnage, and Bralorne Pioneer Mines, Ltd. has been conducting a successful exploration program in the Bridge River area. Kennco Explorations (Western) Ltd. has been drilling a molybdenum prospect in the Alice Arm area, and a similar prospect near Tweedsmuir Park has attracted the attention of Phelps Dodge Corporation.

With exploration crews and prospectors out in force, and the Japanese ready to purchase practically unlimited quantities of concentrates, the profitable mining boom in British Columbia will certainly continue for several years.

END

PRODUCTION EQUIPMENT preview

FOR DATA ON ANY ITEM IN THIS SECTION PLEASE WRITE MANUFACTURER DIRECT

Lockheed Model 60 Utility Transport Airplane Designed for Rugged Use in Mining

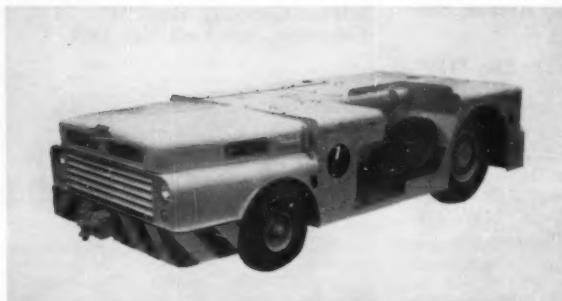


Here is a new type aircraft which may be compared to a conventional aircraft much in the same way you would compare a light truck with a passenger car. This unit is designed to specifically operate under the extreme conditions found in many mining areas throughout the world.

Featuring a high-lift wing and rugged tricycle landing gear, the all metal Model 60 can land or take off in short distances on unprepared fields. With its new Continental 260-horsepower turbo-supercharged engine, the airplane can operate efficiently at sea level or at alti-

tudes over 23,000 feet. A normal useful payload of 1,508 pounds may be housed in a cabin over 11 feet long, four feet two inches high, and four feet wide. A 15.75-square foot cargo door takes bulky freight easily on heavy duty floor (the floor is supported by two seven-inch I beams) which is level with door bottom. Main landing gear struts, made of high tensile strength steel, are swept back 45°. Steerable nose wheel is attached to main fuselage beams. The entire landing gear is designed for high impact damping necessary for rough fields. According to the manufacturer, the Model 60 is designed

for easy and fast maintenance, with all controls, systems and components easy to get at for inspection. For additional information write to: **Steve Barre, Lockheed International, Inc., Dept. MW, 510 West Sixth Street, Los Angeles 14, California.**



Diesel Mining Tractor Is Only Three Feet High

The Frank G. Hough Company has announced a new low-profile, pneumatic-tired "Paymover" tractor with 6,000 or 8,000 pounds drawbar pull for underground mining haulage.

Overall dimensions of this compact, maneuverable unit, the TD-80m, are 12 feet 1 inch long, 5 feet 5 inches wide, and only three feet high. The power train features a six cylinder, flat Diesel engine, torque-converter, and automatic transmission with three forward and one reverse ratios. Spiral-bevel gearing and planetary final drives in rear wheels add to smooth tractive effort.

The TD-80m has a 24-volt electrical system, and both air starting system and exhaust-scrubber are standard equipment. It has hydraulic power-assisted steering, and air-over-hydraulic brakes. Operation is as simple as driving a modern car with automatic transmission. Hood and covers are easily removed for service and accessibility. Write: **M. L. Crawford, Advertising & Sales Promotion, Dept. MW, The Frank G. Hough Company, 859 Seventh Avenue, Libertyville, Illinois.**



40 Yard Scraper Features Many Innovations

Euclid, Division of General Motors, announces its largest scraper—the new Model SS-40 six-wheeler. Payload capacity is 125,000 pounds; struck capacity is 40 cubic yards, with an S.A.E. rating (heaped at 1:1 slope) of 52 yards.

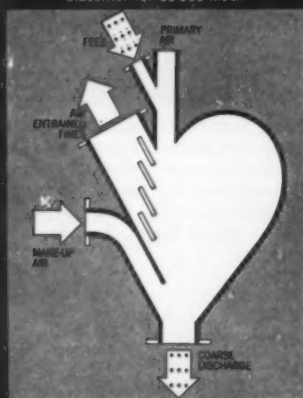
Designed for high production jobs, with long, high speed hauls at speeds up to 34 miles per hour, the SS-40 is powered by a GM 12 cylinder Diesel engine (12V-71) of 432 horsepower. It is equipped with an Allison Torqmatic Drive having four forward and two reverse speed ranges that provide full power shift. Converter lock-up for maximum fuel economy and efficient use of engine power is incorporated in the converter-transmission package. Torqmatic Brake, a hydraulic speed retarder to control speeds on long downgrade hauls, is standard equipment. Engine and transmission oil filters, and the dry type cleaners are conveniently located for fast, easy servicing. Write: **R. E. Keidel, Advertising and Public Relations, Dept. MW, Euclid Division, General Motors Corporation, Cleveland 17, Ohio.**

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Company _____

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TORQUE CONVERTER: "Why a Torque Converter is Standard Equipment in the Eimco Tractor Unique Power Train" is the title of a 24-page book that outlines through pictures, graphs, cartoons, and sketches just what is torque, and how a torque converter works. Write: A. F. Mansbach, The Eimco Corporation, Dept. MW, P. O. Box 300, Salt Lake City 4, Utah.

COLOR-CODED EXPLOSIVES help eliminate the possibility of confusing various grades and types of explosives during blast-hole loading operations, reports Trojan Powder Company. Each grade of Trojan powder is now marked in a distinctive color pattern and this helps to speed-up the loading process since employees can tell by a glance which cartridges to select at any given point in the powder column. Bulletin 101 gives complete details. Write: Dept. MW, 17 North Seventh St., Allentown, Pa.

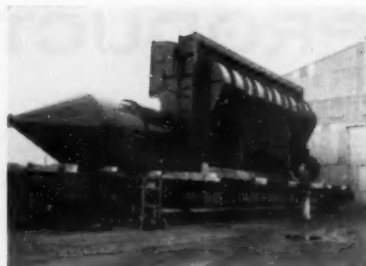
FREE BELTING WALL CHART pointing out various ways to cut down on costly wear and tear of conveyor belting through proper maintenance procedures is available. Subjects covered are: storage, record keeping, alignment, impact idlers, drive pulley lag, loading chute, skirting rubber, automatic switches, inspection schedules, lubrication, fasteners, and repair. For a free copy write: W. R. Needham, Hewitt-Robins, Dept. MW, Stamford, Connecticut.

CRANE-EXCAVATOR: A new, two-color bulletin featuring the Koehring 605 crane-excavator, a one-and-a-half yard shovel and 36-ton crane, has been issued. Write: Koehring Division, Dept. MW, 3026 W. Concordia Avenue, Milwaukee 16, Wisconsin.

DUST SEPARATOR: The Day "HV" centrifugal dust separator is detailed in a new 12-page illustrated brochure which includes performance data, selection and dimension charts, and installation photos with descriptions for the "HV" cyclonic separator and "HV" supports. Write: Day Sales Company, Dept. MW, 810 Third Avenue N.E., Minneapolis 13, Minnesota.

DRIER CATALOG: A new 12-page catalog completely illustrates and describes Cedarapids Portable and Stationary Electric Motor or Combustion Engine Driven Drier Units of medium to large capacity range. Many outstanding owner benefits are described in Bulletin AP-28. Write: Iowa Manufacturing Company, Dept. MW, Cedar Rapids, Iowa.

DRAGSCRAPERS: A new general folder covering dragscraper and slack-line cableway machines; Crescent buckets used with draglines; plus data on wire rope fittings and Duro-lite blocks has been issued. Photographs and line drawings show typical installations, and illustrate the various methods of excavating and hauling. Write: Melvin Martin, Sauerman Brothers, Inc., Dept. MW, 638 S. 28th Avenue, Bellwood, Illinois.



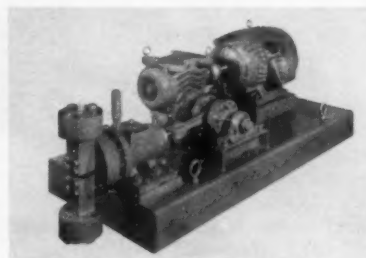
Giant Filter Weighs 23 Tons

The largest filter ever manufactured for the coal industry was recently purchased from Peterson Filter & Engineering company. The filter has 14 rotary discs that measure 12-feet 6-inches in diameter. Its overall length is 27 feet, and when completed will weigh 23 tons. It will have a static area of 3,080 square feet, an area equivalent to a small house. In operation with Peterson's exclusive "Dual Guide" scrapers, the filter will have an equivalent operating area of over 2,750 square feet, and will handle from 75 to 100 tons of coal refuse every hour. Write: Ross Clay, Kay Richins, Inc., Dept. MW, 510 Walker Bank, Salt Lake City 1, Utah.

Free Sulphur Mining Booklet

"Modern Sulphur Mining" is the title of a new booklet published by the Texas Gulf Sulphur Company, leading producer of crude sulphur as mined by the Frasch Hot Water Process.

This is a revised edition of a booklet published several years ago, and updates statistical data and latest production and distribution developments. For free copies write: Sales Department, Texas Gulf Sulphur Company, Dept. MW, 75 East 45th Street, New York, New York.



Pumping Corrosive Slurries

A newly designed Kemlon pump, "Model 150-7," made by Keystone Engineering Company, is a diaphragm type unit specifically intended for handling corrosive slurries at pressures up to 3,000 pounds per square inch.

The new pump has a barrier diaphragm, which separates all the working parts from the fluid handled. Pumping is accomplished by an actuating fluid between the piston and diaphragm without mechanical linkage of any kind. All surfaces of the pump, which contact corrosive media are of Teflon and inert metals. Write: Keystone Engineering Company, Dept. MW, 6310 Sidney, Houston 21, Texas.

WHAT'S GOING ON in mining

Expansion of OME Program Proposed as Government Task Forces To Start Investigation of Mining's Troubled Frontiers

Bert Millar, Bob Hallbauer, and E. Drevdahl Talk On Pits

The "Peace Time Mineral Policy" of the United States is a "Long Term" program, reported John M. Kelly, assistant secretary of the United States Department of the Interior at the Seattle, Washington, meeting of the 1961 American Mining Congress.

"Long Term" is fine and research is the key to long term mineral resource production and utilization, Mr. Kelly said. Many of the operators and officials who listened to the speech weren't interested in this phase. They came to hear of immediate action and plans.

Expansion and modification of the Office of Mineral Exploration's activities is an immediate hope. Mr. Kelly reported, "We are now studying the possibility of expanding the OME program to include financial assistance for mine development and technical assistance in such fields as mining and milling. Rewriting the regulations is also being done to remove objectionable features including the so-called 'Pauper's Oath'."

Immediate reaction and comment to this planned program was that the industry was back where it was about 25 years ago when the Reconstruction Finance Corporation was operating a three-part program of exploration, mine development, and mill construction with technical assistance in all phases and allocation of funds to improve or build new plants incorporating new flow sheets. True, this was during wartime so the only new as-

pect, if and when it comes to pass, is that such a program will be in peacetime.

Now for the immediate future, Mr. Kelly reported that within the new "few weeks" the first task forces will go forth to the frontiers where "declining output of mines and smelters has created economic difficulties in mining communities. The job of these task forces will not be merely to verify what is already widely known, but to find what is happening to mining generally, to exploration and development, and to investments, to confer with leaders, and to begin to develop some proposals as to what might be done."

While no specific details were announced it is understood that about five areas will be investigated at first, that the Area Redevelopment Administration will have an important part, and that local technicians and consultants will be called upon because of their knowledge.

"Mineral resources are created by ingenuity and it takes ingenuity to create resources," reported Thomas B. Nolan, director of the United States Geological Survey. The Geological Survey is expanding its considerable research program to create resources, too, by continuing its geochemical census to acquire data on the distribution of elements in ordinary rocks, to expand the program in the difficult search for concealed ore deposits, and to study and appraise the reserves of truly low-grade deposits.

A. E. Millar, general manager, The

Anaconda Company, Weed Heights, Nevada, reported in detail on how "preventive maintenance pays at Weed Heights." Regular daily inspection by a top mechanic with immediate repair before a serious failure occurs is the key to the program. Trucks, shovels, crushers, conveyor belts, and cranes are inspected daily. A shear coupling in the drive line of the Diesel trucks which breaks before any damage to the transmission gives every indication of a good method to reduce trouble and repair to transmissions, Mr. Millar reported.

Western Canada's first major open pit copper mine is now in full production in Southern British Columbia reported Robert Hallbauer, mine superintendent, Craigmont Mines, Ltd. During the first five months of company operation following the stripping contract (see MINING WORLD, May 1961) three 4.5 cubic yard electric P & H shovels loaded 3,191,000 tons for an average of 6,071 tons per shift. Three to four 30-ton Euclid Diesel trucks hauled an average 1,764 tons per shift with ore hauled 4,200 feet and waste 2,500.

Computer analysis of 27 sizes of trucks, 21 shovels, and 50 haul distances at the University of Arizona was reported by E. R. Drevdahl, associate professor of mining. This involved 28,350 sets of calculations and resulted in these surprising conclusions: Only five truck sizes were considered optimum for conditions built into the program. The rule of thumb for selecting a truck, which has been that it should be filled in four to six dipper passes, is invalid.

Underground Costs Can Be Cut In Raising and Tramming

A new machine to improve an old method of raise-driving at Anaconda Company's Butte, Montana, mines was reported by Leonard P. Colvin, assistant to the chief engineer. Blasting to a large center cut hole has been used at many mines. Not always successfully because the perimeter holes wandered with increased burden and they would not break cleanly. Now the new Ingersoll-Rand

U.S. J. 2 shaft jumbo will accurately drill the perimeter holes exactly parallel to the center cut. Accuracy of hole through any formation to lengths of several hundreds of feet is now possible. The jumbo has important applications for drilling drainage, power cable, ventilation, and sand holes between mine workings.

Tramming costs over underground track have been cut as much as one third

was the report of James W. Clark, Lake Shore, Inc., Iron Mountain, Michigan. He reported that new track laying techniques from Sweden, overlapping adjacent cars in haulage train, and automation of car loading and dumping have all contributed to lower tramming cost.

Chemical grouting using American Cyanamid Company's AM-9 has been successful for cutting water inflow in shaft sinking and for diamond drilling through water bearing sandstone without the necessity of casing, reported Victor L. Stevens, Boyles Bros. Drilling Co.

New Flotation Reagents For Low-Lime Copper Circuits

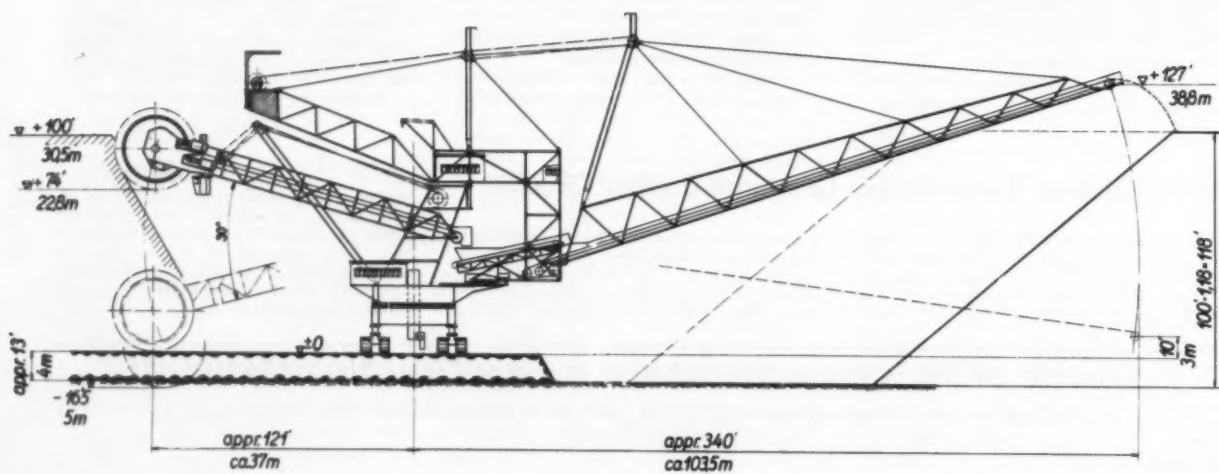
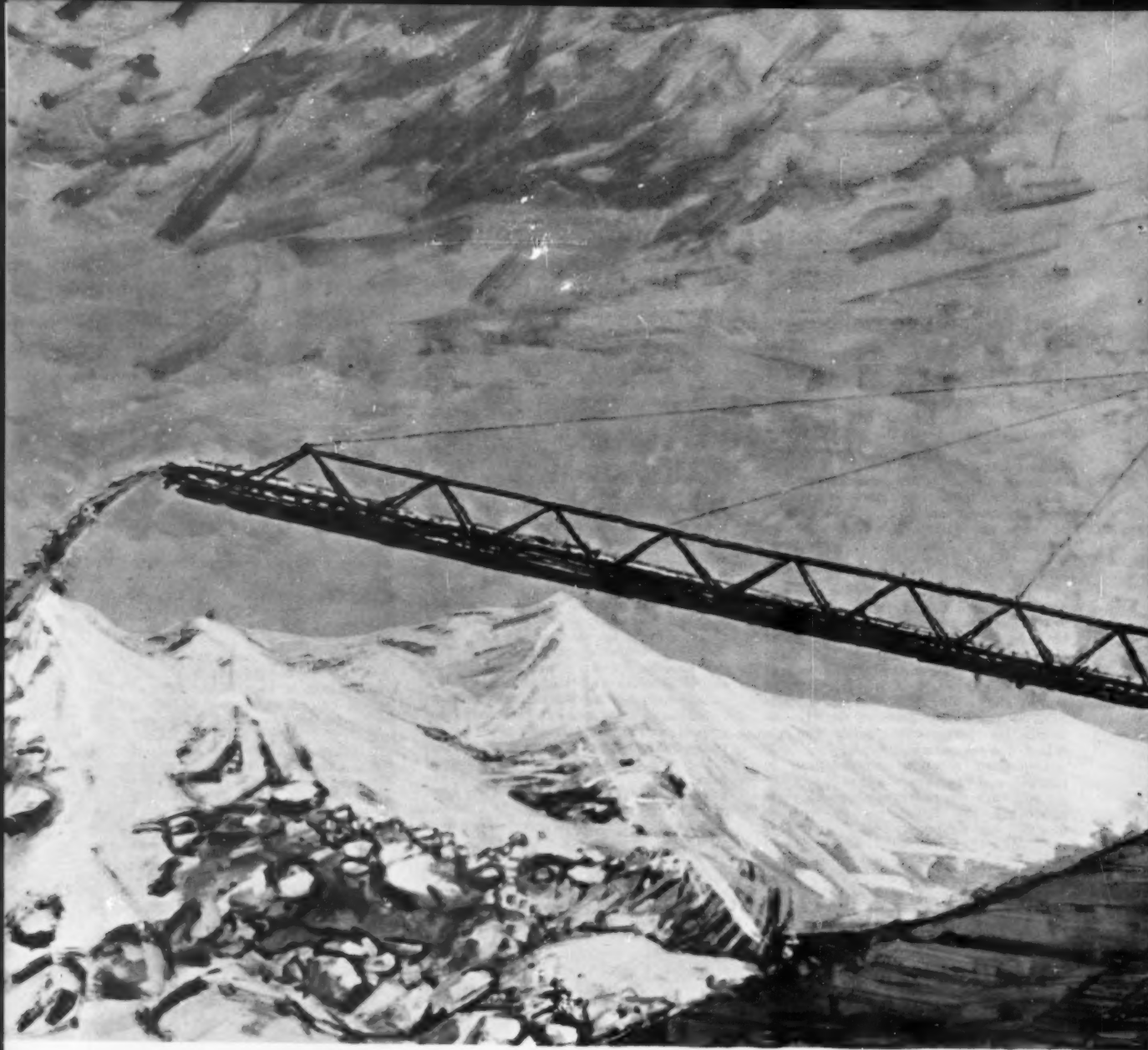
Lowering the cost of lime for copper flotation concentration, one of the main goals of the research program of the American Cyanamid Company, is the good word to operators from E. P. Cad-

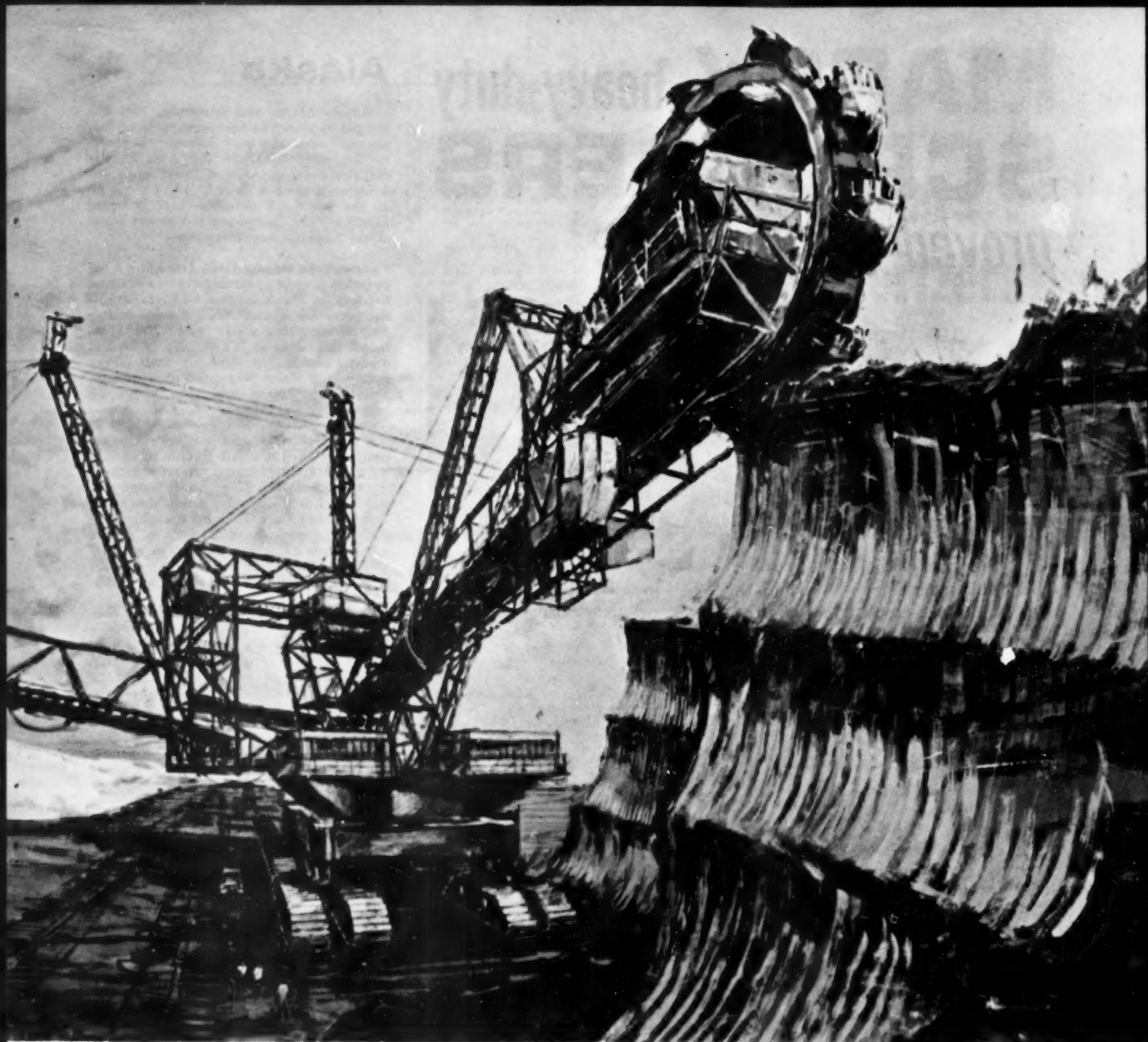
well of the company's mining chemicals department. Three new chemicals with equivalent selectivity to those in use at present, but in low lime circuits, are now being field tested, he reported. Higher

selectivity in cleaner circuits to produce higher grade concentrate has been accomplished, he added. Other improvements that have cut copper milling costs have been the use of larger diameter grinding mills, X-ray analysis, bulk flotation with selective depressants, and pH control equipment.

WATCH FOR THE 1962 MINING CONVENTION TO BE HELD IN SAN FRANCISCO SEPTEMBER 24-27

It will feature extensive equipment exhibits as well as the presentation of technical papers.





3,000 ton wheel excavator for a North American mining operation

During the past five years a machine of similar capacity removed a total of 150 million cubic yards of dirt for a West German power combine. Operating around the clock, the machine averaged 100,000 yards a day.

We advise on all projects involving mining of minerals and their transportation. We develop complete surface and underground mining schemes and the necessary mechanical equipment, based on the broad experience of our mining and materials handling engineers.

We design and build mining and construction equipment, including bucket chain excavators, bucket wheel excavators, loaders, spreaders, stackers, special equipment, complete bunkering plants, conveyor bridges, stationary and movable conveyors.

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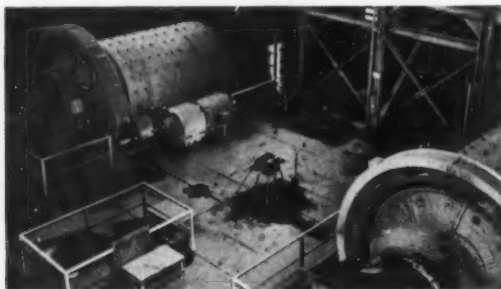
In the Continental U. S. contact: KRUPP INTERNATIONAL INC., 375 Park Avenue, New York 22, N. Y.

MARCY heavy-duty SCRUBBERS

proved performance

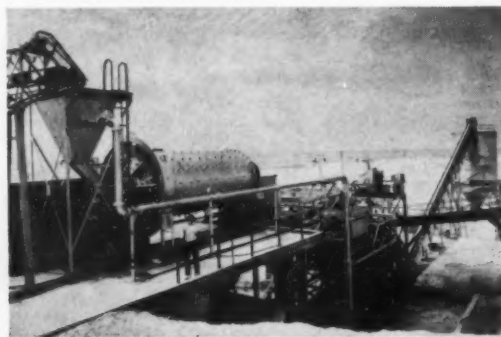
on iron

...two 9½' x 19½' Marcy Scrubbers successfully handle tough iron ore cleaning problem on Mesabi Range. This installation resulted from use of Marcy Scrubbers in two of the company's other concentrators.



on coquina shells

...7' x 16' Marcy Scrubber washes a minus 10" feed of coquina shells and pebbles for a large copper company in Peru.



Why you can cut costs with Marcy Scrubbers

- Marcy principle of small diameter, long length gives positive, active scrubbing, less short-circuiting, and low horsepower.
- Heavy duty construction, operation on trunnion bearings, and properly designed drives, combine to eliminate vibration.
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Alaska

Alaska Mines and Minerals, Inc. has limited exploration for mercury to underground work the past summer. Drifting to intersect the Dolly ore zone on the 600-foot level of the Red Devil mine was a major project with only 100 feet to go at the first of September. Ore is being mined for the 30-ton-per-day retort plant at six underground locations.

New York Alaska Gold Dredging Corporation is only operating two bucket line dredges in the Kuskokwim River drainage area this season. No. 3 dredge is digging three shifts a day about five miles below the camp at NYAC. No. 4 boat is digging on a one 10-hour shift along Bear Creek about five miles above camp. Total employment has been about 28 men during the summer.

Dorr Holloway and an associate are trenching with a small tractor on a cinabar prospect located about ½ mile from Kuskokwim River on the opposite side and a mile upstream from Sleetmute. Encouraging float has been found in subsurface "creeping" talus, but its source is unknown. The mineralization appears to be associated with fine-grained sills intruded along bedding (?) of the shales.

Utah Construction and Mining Company operating through a subsidiary—Mt. Andrew Mining Company—has kept a field crew of geologists, geophysicists, and diamond drillers busy during the summer on Prince of Wales Island almost due west of Ketchikan. Iron and copper are the minerals sought in continuation of a program which saw extensive drilling around several well known old mines on the Island in 1960. Hollis Peacock, chief geologist, is in charge of the work.

Shattuck Denn Mining Corporation has acquired control of the uranium deposits of Bay West, Inc. near Ketchikan. High grade ore is being mined for shipment to one of the uranium mills in the southern states. A program of exploration and development is also being carried out. Shattuck Denn is a major independent producer of Utah uranium ores.

Arizona

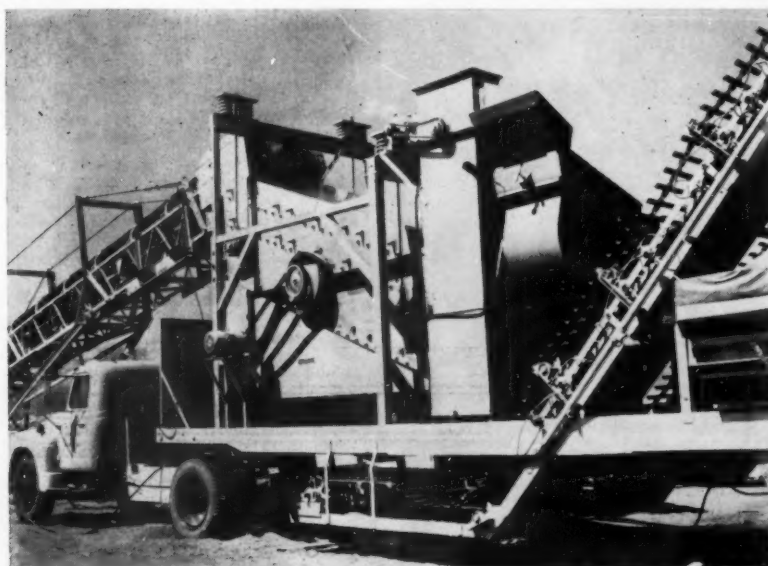
Arizona Professor Publishes Book on Excavation Equipment

"Profitable Use of Excavation Equipment" by Elmer R. Drevdahl, Jr., associate professor of mining engineering, University of Arizona, is a new book to be used as a standard for estimating capabilities and costs of excavation equipment as used in construction and mining industries. The work provides a complete analysis giving a reference point for equipment systems simulation, analysis, and profit. Covered are fundamentals of equipment analysis with reference information, information on equipment output and costs, and complete tables.

Written in everyday language, the book makes dollars and cents out of any cost system as it shows how to keep and use a record that will open into an amazing picture. Profits are not guessed—they are planned. The cost of the book is \$10.00 (plastic binding) or \$13.50 (cloth binding) from Desert Labs., Inc., P. O. Box 4666, Tucson, Arizona.

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United Placer is Arizona's Latest Dry Land Dredge

A new mining process, utilizing a dry land dredge that operates without water, has been developed by United Placer Industries, Inc., a newly incorporated firm headquartered in Chicago. UPI is currently operating the dredge on claims along Weaver Creek, in the San Domingo and Weaver areas in Arizona, about 50 miles northwest of Phoenix. The unit reportedly can process 75 to 100 cubic yards of gravel per hour, and can be operated profitably on a recovery of placer gold averaging 45 cents a yard. The dry placer machine is of conventional sand and gravel handling type at its feed hopper. Material is dumped into the small hopper fitted with a six-inch grizzly by means of front end loaders. The minus-six-inch material travels over a 60-foot-long conveyor to a triple deck screen. Feed is then directed to the infra-red dryers, which consist of a drag conveyor on an extremely steep slope equipped with a battery of infra-red lamps. The lamps are placed below the deck of the drag conveyor and flights of the conveyor then tumble and rotate the feed as it is dragged up the slope. The electrostatic separation tables contain decks on a 7° slope. The tables are long

and narrow, and the decks are fitted with fine mesh screen cloth. Air passing through the screen cloth puts an electrostatic charge on the screen, which helps attract metals and sulphides as they are distributed at a uniform feed rate across the up-slope end of the table. The gold concentrates itself at the feed end of the table. Designed as a portable unit that can move from one location in a dry wash to another, the model pictured above is loaded from the wash by a crawler track-type tractor. Electric power is furnished by a Diesel electric generating unit of 60 KW capacity. Final concentrates are removed from the tables by industrial vacuum cleaners, then placed in a small dry washer for a final dry process, proceeding final cleanup of the gold by wet panning. Company engineers estimate that present cost of production ranges from 45 to 55 cents per cubic yard, but hope that this cost can be progressively decreased to as low as 25 cents per cubic yard. The company is also designing a larger machine, to handle 500 to 1,000 yards per hour. Mrs. Geraldine Freund is president of the company; Mason Rankin is chief geologist in charge of the Arizona operation.

Laboratory Crushers and Pulverizers



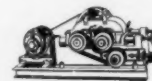
4"x6" Massco Laboratory Jaw Crusher

Welded steel frame; manganese steel jaw and cheek plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear and product size by convenient hand wheel adjustment.



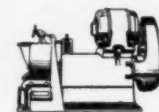
6" and 10" Massco Gy-Roll Reduction Crusher

Reduces 1/2" feed to as fine as 10 mesh in single pass. High capacity, low power consumption.



Laboratory Crushing Rolls

Sizes (Diameter x width): 10"x6" and 12"x8". Adjustable roll space setting up to 3/4". V-belt drive. Heavy, cast frame absorbs vibration, results in long life.



Massco-McCool Pulverizers

Disc type grinder with a planetary movement. No gears. Will grind 1/4" to 150 mesh in one pass.



Marcy Pulp Density Scale

Gives direct reading of weight; specific gravity of liquids, pulps, and dry solids; percent solids in pulp. Very accurate. Easy to clean.

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Leaching operations at the old DeSoto mine, near Mayer, Arizona, are producing five to six tons of copper sludge per week. The material is said to assay up to 80 percent copper. The property is operated by **Chilson Mining Company**, headed by R. E. Chilson of Tucson.

Western Gold and Uranium, Inc. has acquired the Lee Ackerman Investment Company, Inc. of Scottsdale, Arizona, through the issuance of an additional 200,000 shares of its treasury stock. When the agreement becomes final, Lee Ackerman will be elected president of Western Gold and Uranium, and Richard W. Ince will continue as chairman of the board. It is the intention of the company to continue the operation of the Orphan mine at Grand Canyon and other affiliated mining operations, as well as develop new sources of income through its

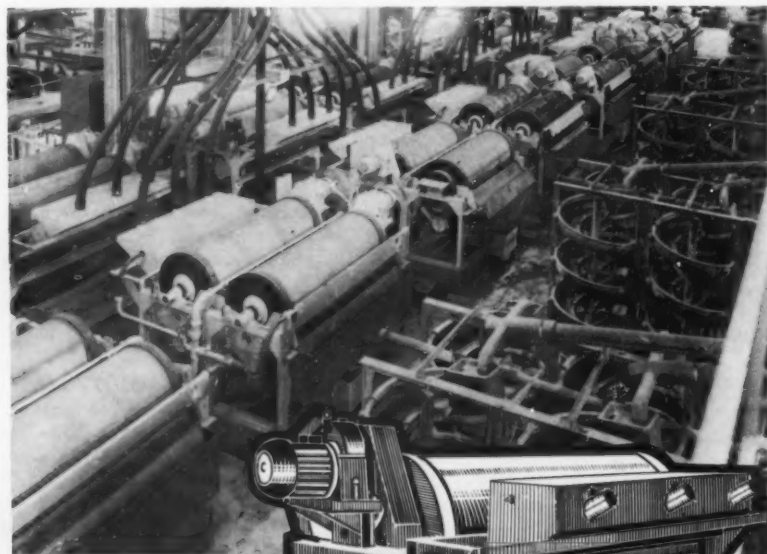
new wholly owned subsidiary. The principal offices of Western Gold and Uranium will be moved from New York City to Phoenix.

The McDonald shaft at the Christmas mine of **Inspiration Consolidated Copper Company** was completed to final 1,780 foot depth recently, and driving of the 1600-foot level main haulage drift toward the development shaft and ore body was started. Two headings are being driven from the underground development shaft and ore body toward the McDonald shaft, with progress in one of these drifts being slow and difficult because of water. The hoist and compressor building, warehouse, change house, and office are all in use on the surface. Heavy crushing machinery has been installed, and construction of crusher buildings and auxiliaries is nearing completion, as is the fine ore storage

building and its feed conveyor system. Mill foundations and machinery placement are well advanced, though considerable work remains to be done on building erection, piping, wiring, and auxiliaries.

Industrial Uranium Corporation expects to mine between 50,000 and 60,000 tons of ore during the current fiscal year (ending March 31, 1962) from uranium properties in Monument Valley, Arizona. During 1960, the company carried out a \$30,000 exploration program resulting in the discovery of another ore body in the area of modest size. Robert M. Schuchbach of Salt Lake City is president.

Lack of rainfall is causing great concern at Ray Mines Division of **Kennecott Copper Corporation**. The 1.96 inches of rainfall at Ray is the second lowest year-to-date figure since 1923, and the 1.24 inches at Hayden represents the third lowest in a 34-year period. Last year's totals of 11.54 inches at Ray and 5.96 inches at Hayden were also considerably lower than the average annual figures of 18.36 inches and 11.10 inches respectively. The Arizona drought is practically statewide, and **Bagdad Copper Corporation** recently made some production curtailments because of water shortages.

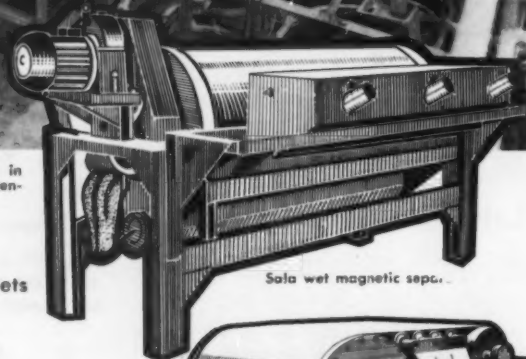


Sala wet magnetic separators in modern Swedish iron ore concentrator.

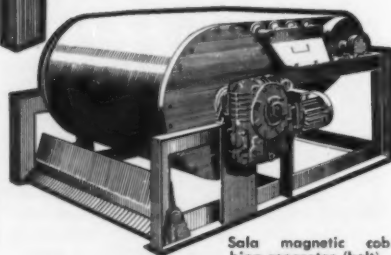
SALA SEPARATORS with permanent magnets have a world-wide reputation for proven performance

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California

Jefferson Lake Asbestos Readies California Operation

One of the most important asbestos deposits in the western United States, containing reserves estimated to be over 20,000,000 tons, expects to be in full scale operation by April 1962. The Jefferson Lake Asbestos Corporation, 77 percent owned by Jefferson Lake Sulphur Company, has awarded a mill construction contract of \$5,272,114 to Tellepsen Construction Company of Houston, Texas, with engineering and design being handled by Kilborn Engineering, Ltd. of Toronto, Canada. The mill will be of conventional design incorporating the latest mill circuits and equipment.

A mining contract has been let to Wells Cargo Company of Las Vegas, Nevada. A three-and-a-half-mile access road has been completed by Wells Cargo, and Tellepsen is now moving in to begin foundation work. By the time operations start up in 1962, the project will employ a total of about 170 people. R. W. Prince is general manager, and Gerald Jansen will be mill superintendent.

Sonoma Quicksilver Mines, Inc. has ceased operations at Guerneville, California, due to steadily declining prices for quicksilver on the world market. The company will continue to be active in mining, particularly in South America where it operates a tungsten mine near Oruro, Bolivia.

The \$600,000 asbestos plant of **Todd Industries, Inc.** at Coalinga, California, is now operating, and has made the first shipment of 120 tons of asbestos fiber to Los Angeles. Until August of this year the plant had been operating as an experimental laboratory perfecting a refining process for the special type of amorphous asbestos found northwest of Coa-

linga in Fresno and San Benito Counties. Success of the operation is due to a new milling process designed by W. W. Davis of Davis Engineering Company, Phoenix, Arizona, that solved the problem of economically freeing the fibers from the parent rock.

American Potash & Chemical Corporation has awarded a contract to C. F. Braun and Company for the engineering design of a \$15,000,000 plant to manufacture titanium dioxide near Mojave, California. The plant will provide the first source of refined titanium dioxide west of the Mississippi River to serve the substantial requirements of the paint, paper, rubber, plastics, floor covering and other industries.

Central

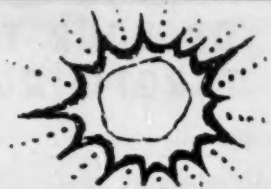
The General Services Administration of Washington, D. C. has rejected all eight bids submitted for the purchase of the multi-million dollar nickel-cobalt refinery at Fredericktown, Missouri because they were "inadequate." The two highest bidders were Heat and Power Company, Inc. of New York City (bid: \$203,333), who wanted the plant for salvage purposes; and the National Lead Company (bid: \$200,000), who wanted it for possible future use. It is believed the General Services Administration is making every justifiable effort to award the plant to a firm interested in its continued operation.

The 1961 National Safety Congress, annual convention of the National Safety Council, will be held in Chicago, October 16 to 20, with mining sessions being held in the Pick-Congress Hotel. Further information may be obtained from R. L. Forney, secretary, National Safety Council, 425 N. Michigan Avenue, Chicago, Illinois.

At the request of the fluor spar industry to aid in the exploration for unknown deposits, new geological maps of the Illinois fluor spar district are now being prepared by the state geological survey. The mapping program covers Hardin, and adjacent parts of Gallatin, Saline, and Pope counties, which were last mapped by the survey in 1920. The new maps will have a scale of 2½ inches to a mile, and will have an accompanying report briefly describing the rock formations, structural features, and economic geology of the area.



The Getman Brothers' KD-5A Scoot-Crete uses an air-cooled Deutz Diesel.



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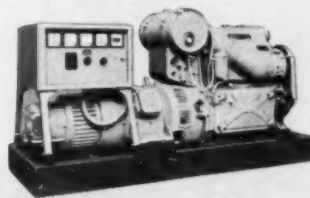
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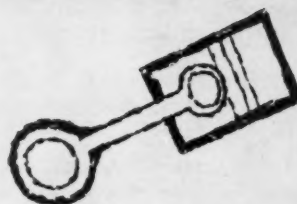
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F6L 712	78	2300
F/A3L 514	48	1800
F/A2L 514	32	1800
A4L 514	72	2000
A6L 514	110	2000
A6L 614	110	2000
A8L 614	145	2000
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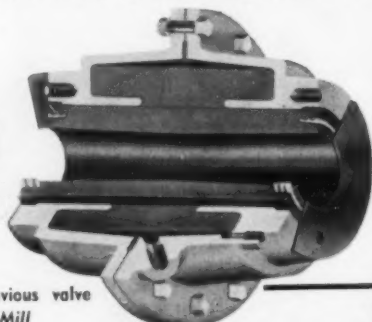
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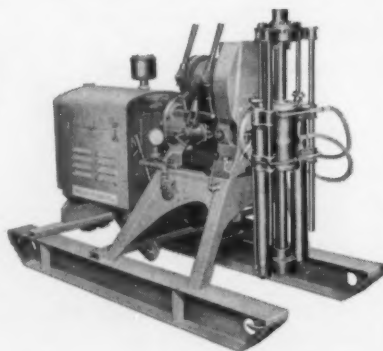
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The importance of buried Precambrian rock as a possible source of iron, lead, and zinc deposits is now being recognized in the States of Iowa and Kansas. Dr. H. Garland Hershey, state geologist of Iowa, has obtained a \$100,000 appropriation from the state legislature for a survey of possible underground wealth, particularly in western Iowa where "high gravity readings" have indicated Precambrian volcanics. The State Geological Survey of Kansas has recently published a book titled "Wells Drilled Into Precambrian Rock in Kansas" which tells the depth of basement rocks in all parts of the state, and includes a structure map contoured on the top of the Precambrian. At places in the Mississippi Valley the Precambrian basement rock complex is within 600 feet of the surface.

Colorado

Beaver Mesa Uranium Company has set a 50,000-annual-ton mining rate from its mines on Beaver Mesa, Mesa County, Colorado through 1966 according to Alan M. Simpson, president. The rate will allow it to fill its 238,000-pound uranium oxide allotment from the AEC. The company has just declared its first dividend.

Morrison-Knudsen Company Inc. is developing an open-pit iron ore mine on a massive iron ore deposit high above Ashcroft, Pitkin County. The project termed, **Colorado Ore Hauling**, is managed by Meade Harker, of Carbondale. Selective mining is necessary because of the irregular and often high sulphur (pyrite) content of the ore.

Completion of the Ceresco adit and initial mine development for **Climax Molybdenum Company** is scheduled for November by **Boyles Brothers Drilling Company** under its contract with Climax. Concreting has been completed to the No. 1 switch; work is well advanced on 4,000 feet of fringe drifts and two ventilation raises. Heavy wet ground slowed progress and necessitated close timbering ahead of concreting. Dave Vosberg is Climax's project engineer.

U. S. Beryllium Corporation has leased the California mine and a group of patented and unpatented beryllium claims on Mount Antero, Chaffee County from G. G. Furman of El Paso, Texas. The California vein varies from 18 to 36 inches in width and has been developed by adits from which a number of aquamarine gem stones were mined many years ago. Dumps and float from the vein are now ore-grade beryllium which will be loaded into trucks and hauled to Badger Flats, Colorado where U. S. Beryllium's main mines are located. Ore will be delivered, under processing contract, to **Mineral Concentrates and Chemical Company's** (Mincon) new flotation mill on Badger Flats. Don H. Peaker is president of U. S. Beryllium, the "Small Mining Company of 1960" as honored by MINING WORLD.

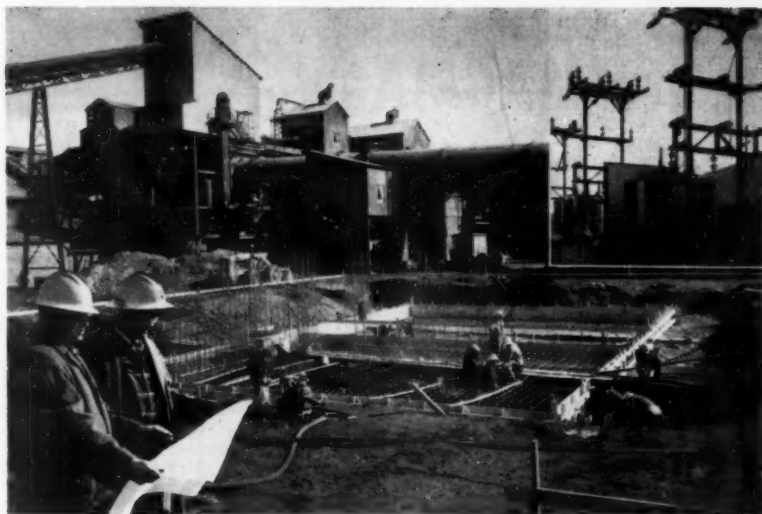
Climax Molybdenum Company has developed a new self-propelled underground ditch digger for use on the Storke Level of the Climax mine. The machine, the first of its kind in the world, was designed by Climax engineers Snell Burke and William Nelson. It will dig footings and clean ditches to solid rock in preparation for concentrating the drifts.

Eastern

In order to adapt the reverberatory furnace to smelt copper calcine from the new fluid-bed roaster, the copper smelting facilities of the **Tennessee Copper Company** were shut down for three weeks in July. The extensive repairs included rebricking the reverberatory furnace, repair of the smelter stack, construction of a chute for charging hot calcine from the roaster into the side of the furnace, and replacement of various steel supports.

According to the second quarter, 1961, financial report of the **American Zinc, Lead and Smelting Company**, only two of its Tennessee mines, Mascot No. 2 and the Young mine, are being operated. The Coy mine is on development and other mines are closed, although the Washington, Wisconsin, and the American-Peru joint operation in New Mexico, were operated throughout the quarter. The company's joint venture drilling operation with Granite City Steel Company prospecting for iron ore in southeast Missouri was active throughout the quarter.

Expansion of facilities for producing calcined phosphate rock at the Nichols, Florida, plant of **Virginia-Carolina Chemical Corporation** is now completed. Annual capacity has been increased by 400,000 tons with the addition of a new 10- by 160-foot rotary kiln plus various control devices including closed-circuit television.



New Jersey Zinc Builds New Spiegeleisen Furnace

Construction is underway on the first commercial electric smelting plant to use the Sterling process for making spiegeleisen in the United States. New Jersey Zinc Company is building the furnace at Palmerton, Pennsylvania to make this iron-manganese alloy by smelting iron-manganese ores from the company's Sterling mine at Ogdensburg, New Jersey. The company's manager of engineering, J. R. Connelly (left) and construction engineer, H. H. Rahn, discuss plans for the furnace. Inset at top right shows electric sub-station area which will be enlarged to accommodate increased transformer capacity.

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The iron mine of Republic Steel Corporation at Lyon Mountain, New York, has been closed for an indefinite period because of lack of orders for ore. The shutdown is the third this year, and some 200 employees have been laid off.

Idaho

An easterly exploration tunnel being driven by The Bunker Hill Company from the 23 level of the Bunker Hill lead-silver mine at Kellogg, Shoshone County, is out more than 2,300 feet from the Bunker Hill shaft. An additional 6,400 feet of crosscutting and drifting will reach ore participation areas in the Yreka United area. Another drive toward the area is scheduled to get underway later this year. The work is progressing 250 feet monthly on a two-shift basis. A recently-installed sand-filling system in the Bunker Hill mine is operating efficiently. J. E. Gordon is manager of mines and C. E. Schwab is company president.

A \$50,000 sink-float plant is being installed at the Rex flotation mill north of Wallace, Shoshone County, to upgrade gob left in old stopes of the Interstate-Callahan mine. The mill is owned by W. C. Kennedy and Herbert Zanetti, Wallace, lessees of the Mountain Goat zinc-lead mine from Day Mines, Inc. They also have leased the Interstate from Day Mines. The Mountain Goat veins are extensions of the Interstate veins and the lessees have made a connection on the 1,500-foot level of the Interstate. The crew is being expanded from 15 to 23. The sink-float plant was purchased from Western Exploration, Ltd., Silverton, British Columbia.

Silver Pirate Mining Company, Kellogg, recently levied an assessment of 1.0 cent a share to finance annual work requirements on its unpatented mining claims near the head of Big Creek in the Coeur d'Alene mining region. Bulldozer exploration of two veins is planned. Mary A. Nash is secretary-treasurer.

In Custer County, Clayton Silver Mines is concentrating on development of the new 800-foot level in the Clayton mine. Installation of a new hoist has been completed. The firm, which has a 24-man payroll, mined ore valued at \$140,000 in the first half of this year. Norman Smith, Big Creek, is managing director.

Sunshine Mining Company is taking a new look at western hemisphere areas with past records of silver production. Operator of the nation's largest silver mine, in Shoshone County, Sunshine produced 1,717,639 ounces of silver in the first three months of this year. It also produces lead, copper, and antimony. Sunshine's antimony plant recently began treating silver-copper concentrates from the nearby Polaris mill of Hecla Mining Company. Planned for installation in the Sunshine mill this year is a regrind circuit to upgrade lead-pyrite concentrate. Robert M. Hardy Jr., Spokane, is company president.

Iron Ranges

The Iron Range Resources and Rehabilitation Commission has approved a loan of not more than \$77,500 for a cost-type contract between Zontelli Brothers of Ironton, Minnesota, and the Krupp-Renn Company of Essen, Germany. The commission approved a proposed contract with Zontelli providing for them to oversee experimental work on the direct reduction of lean ores for the Mesaba or Cuyuna iron ranges by the Krupp-Renn process. The Minnesota ores would be shipped to the Fried Krupp plant near Essen, Germany. The plans call for the shipping of about 60 tons of ore to Germany as well as approximately 30 tons of fuel and about 15 tons of limestone flux. Should the experiments prove successful, Zontelli Brothers will consider the possibility of building a plant on the Mesaba or Cuyuna range at a cost of about \$27,000,000. Zontelli Brothers reported to the commission that preliminary tests have been made by Southwestern Engineering Company of Los Angeles, California, with Minnesota low-grade ores, and these tests have produced a product which assayed about 94 per cent iron.

Completed in the spring of this year, the Sherman mill of Oliver Iron Mining Division, United States Steel Corporation, is now in full operation. The new mill, which consists of a heavy-media, spiral, and cyclone section, is fully automated. In addition to the use of fully automatic controls for all equipment, the use of monitoring television cameras has found its place in watching rapidly moving conveyor belts. The plant is located

just north of Chisholm, Minnesota and treats ores from the Oliver's Sherman mines group.

Construction of additional concentrating and pelletizing facilities at the Republic mine of The Cleveland-Cliffs Iron Mining Company at Republic, Michigan is proceeding on schedule. During August most of the machinery was set in place. The mill is scheduled for operation sometime around February, 1962. Contractor for the concentrator portion of the expansion is The W. M. Kellogg Company of New York, New York. Arthur G. McKee & Company is building the pelletizing facilities.

The 23rd Annual Mining Symposium of the University of Minnesota, and the annual meeting of the Minnesota Section of the AIME will be held jointly in Duluth January 15 to 17, 1962. The program will feature some 20 technical papers at six sessions covering the following subjects: Beneficiation and Agglomeration of Taconites, Magnetic Roasting and Metallized Pellets, Blast Furnace Performance With Agglomerates, and New Developments in the Exploration, Mining, and Beneficiation of Iron Ores. Details may be obtained by writing the Director, Center for Continuation Study, University of Minnesota, Minneapolis 14, Minnesota.

By 1981 40 percent of all iron ore consumed in the United States will be taconite pellets, according to a recent statement made by an executive of a major steel producer. Results of an all-pellet furnace are cited as being 84 percent more productive, with 34 percent less coke, 30 percent more wind, and a dust reduction of 55 percent as compared to a 90 percent ore furnace burden.

Montana

Method of Breaking Rocks Electrically Tested in Montana

A method of breaking rocks electrically has been successfully tested by the Montana School of Mines and Westinghouse Electric Corporation under a research grant from The Anaconda Company. The single step employed in breaking rocks electrically is in sharp contrast to the time-consuming conventional methods involving drilling and the use

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of explosives, and is applicable to secondary blasting.

Francis M. Young, directing the research program at Butte said, "The use of electricity to break large rocks shows great promise for improving the efficiency of mining, and the successful application of the principle would provide safer, faster, and simpler methods for rock breaking. The electrical approach is decidedly safer because the rock gradually crumbles instead of disintegrating violently as it does under the impact of explosives."

The equipment used consists primarily of a radio-frequency generator similar to a small but powerful radio transmitter. Instead of sending out its power through the usual antenna, the power of the generator is directed through wires to the rock. The concentrated high frequency current heats a path through the rock which expands more than the unheated areas. This differential expansion causes the rock to crumble. The presence of small amounts of water in rocks assists in this process.

Jack Waite Mining Company is planning new exploration for additional lead-zinc ore reserves at the Jack Waite mine on the Montana-Idaho border in Mineral County. American Smelting and Refining Company recently gave up its lease on the property. The Jack Waite firm also is examining adjacent mining properties. Philip A. Borelli, New York City, is president.

The Anaconda Company is seeking contract miners in 11 western states for employment in the Butte mines. The company has added 235 miners to its Butte payroll in the past four months. Increased employment was brought about by the reopening of the Leonard mine. The deep level development program announced this past spring is requiring more miners.

The Consolidated Mining and Smelting Company of Canada is considering the possibility of building a \$4,000,000 plant in western Montana to process phosphate ore. The Montana Phosphate Products Company, a subsidiary of the Canadian firm, holds phosphate ground in Granite county. The ore is low-grade, and must be processed and up-graded before shipment.

Nevada

Standard Slag's New Mill To Produce Sinter Grade Products

Standard Slag Company has begun construction of a \$1,000,000 mill to boost ore production from its open-pit iron mine located 17 miles northwest of Yerington, Nevada. Present daily production is 1,500 tons, which is sent to Stockton, California, for shipment to Japan.

The new mill, scheduled to begin production in March 1962, will up-grade iron sulphide ores to produce a sinter-grade product. The mill presently being used is a crusher concentrator with magnetic separators.

The mill site has been cleared, as well as the location for future office buildings and warehouses. All new facilities will be constructed north of the present office and mill operations.

John Harmon is general superintendent of the operation.

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The Watt and Patrick silver mines, just north of Austin, are to be reopened in the near future according to an announcement by the White Caps Gold Mining Company. Hoists and compressors are now being installed, while mucking machines and other equipment will be brought in shortly. The Watt and Patriot were two of the highest grade early day mines in the Austin area, and earlier this year some dump samples were taken that reportedly assayed 7,560 and 2,688 ounces of silver per ton.

A new award has been added to the long list of safety honors won by the Nevada Mines Division of Kennecott Copper Corporation. A Joseph A. Holmes award was given to management and employees of the Liberty pit and Deep Ruth mines for working 7,433,983 man-hours without a fatality or permanent total disability from January 25, 1956 and continuing.

Louis V. Cirac and John Lambert of Pacoima, California, have acquired by lease and option the Keystone group of claims in the Manhattan mining district of Nye County, Nevada, where previous operations had developed a considerable tonnage of ore, mainly gold with some silver. Tests made on this ore recently indicate a cyanide leach may be used for a low cost milling process. Further mine development and construction of a 100-ton-per-day leaching plant is now being planned for the property. The operation will be consolidated into a new Nevada company with placer gold holdings in the Union mining district of Nye County, and copper property in Mineral County near Thorne, Nevada.

New Mexico

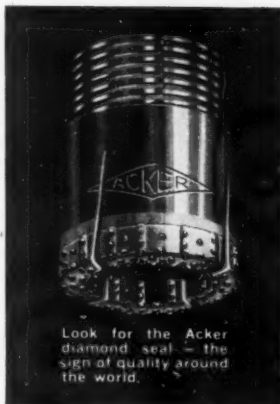
Physical examinations are to be given to 2,500 Ambrosia Lake uranium miners and all underground working areas are to be examined once a month under a United States Public Health Service grant of \$54,500. The contract for the examinations over the last six months of 1961 has been signed with the New Mexico State Health Department which will supervise the project. The survey will seek, among other things, to eliminate any potential health hazards from radioactivity.

Calumet and Hecla, Inc. is diamond drilling to extend ore reserves at its Marquez uranium mine in the southeastern end of Ambrosia Lake. The current program is exploring west of the main stopes which are reached through a long truck incline. About 110 men are employed at the mine under the direction of R. W. Kleibenstein, mine manager, and Glen Johnston, mine superintendent.

In addition to installation of a multi-million dollar skip hoist system at its copper mine near Santa Rita, New Mexico, Kennecott Copper Corporation has scheduled several other expansion projects for its Chino Mines Division. At the precipitation plant, the program begun in 1960 for completion this year, includes dams to catch and hold the flood water, new pipelines and a bigger pumping capacity. The mine maintenance department will undertake several major overhauls and rebuilding jobs for shovels, drills, trucks, and other large equipment items. Preventive maintenance for all mobile units and all

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pieces of machinery will receive emphasis. Power lines in the pit will be extended to meet increased needs. At the mill instrumentation will be installed on various units to improve recovery of copper from ore. This program includes use of delicate instruments to detect changes in quality or amount of feed and adjust speed of machine, flow of water and addition of reagents automatically. The company is studying different types of lubrication systems for possible use in the mill. At the mine the company will do research on blasting techniques. Use of rubber-tired dozers will be extended to more dumps, new railroad inclines will be completed, and the Lee Hill ore body will be developed. The company will continue research projects for devising better methods of smelting and refining copper, and has scheduled repair and rebuilding of some units at the smelter.

Oregon

Large amounts of perlite having good to excellent expansible properties are available in southeastern Klamath County and southwestern Lake County, according to a new report of the Oregon Department of Geology and Mineral Industries.

Federal Resources Corporation is planning 1,500 feet of crosscutting and drifting in the **Queens** mine, Bellevue area, Blaine County, under an operating agreement with **Silver Star-Queens Mines, Inc.** Geological work in the Minnie Moore mine and other work also is planned to obtain a 60 percent interest in the properties. Nels W. Stalheim, Salt Lake City, Utah, is board chairman.

James P. Jackson, Jr., owner and manager of the **Buffalo** gold mine in Grant County is carrying on a successful deep level exploration project. During the last two years he has driven about 1,500 feet of new adit to hit the Constitution vein on the 600 level which is 253 feet below the south end of the last known drift on the 400 level. After hitting the vein in early July he turned north and in one month drifted about 265 feet following the two- to three-foot wide vein. The vein carries gold, silver, copper, and zinc values. The cross cut adit cut through the No. 3 vein before reaching the Constitution. Where intersected it was narrow, but should widen to the north. Oregon geologists report this work proves that these veins, and presumably others, in the Granite mining district persist at depth and can be located and mined profitably.

Utah

The fluorine contained in the extensive phosphate deposits of Montana, Utah, Idaho and Wyoming is the subject of considerable research by **Stauffer Chemical Company**, according to **Elwood I. Lentz** of **Western Phosphates, Inc.**, in which Stauffer has a 50 percent interest. Stauffer through **San Francisco Chemical Company**, is developing the 700,000,000-ton **Humphreys** phosphate deposit 15 miles north of Vernal, Utah. In these four western states there are some 3,000,000,000 tons of phosphate rock available for mining and the fluorine content of most of it is between three and three and one-half percent hydrogen fluoride. Since uses for fluorine compounds in produc-

tion of uranium fuels, as an oxidant in missile fuels, as a dental aid in drinking water, and in the aluminum and chemicals industry are increasing rapidly, it is probable that phosphate producers expect to recover the fluorine from their deposits. San Francisco Chemical is currently engaged in a test shipment of phosphorite concentrates from the Humphreys mill of the triple superphosphate plant operated by Western Phosphates at Garfield, Utah.

The Hidden Splendor Mining Company is now mining high grade uranium ore from its Louise and South Almar uranium mines in San Juan County's Big Indian district. High grade ore is also being mined from the North Almar in comparison to low grade production during 1960. The Louise and South Almar are rapidly becoming the largest company producers in the district as the Ike-Nixon ore body has virtually been mined out, the Radium King is being operated by a lessee, and the Columbia production remains stable.

The current year is termed a "good evaporation season" by Bonneville Ltd. which produces potash and other salts by solar evaporation of Great Salt Lake brine at Wendover, Utah. The company has completed new brine wells, new dikes, and evaporation ponds to increase production. The company has signed contracts for shipment of most of the 1961 production. Export to Japan is an important market.

Washington

Barite mining is increasing in Stevens County. Production currently is coming from operations in the Williams Lake, Chewelah, Valley, and Kelly Hill areas. About 1,000 tons a month are being mined at the Uribe property in the Williams Lake district eight miles north of Colville. Fred Kennedy Construction Company, Sandpoint, Idaho, is doing the mining under a sub-lease from Darrell Newland, Colville mining man. Ore is trucked to Evans and loaded aboard railroad cars for shipment to Clear Lake, Washington, where it is powdered and then shipped to Alaska for use in oil well drilling.

Work has started at two gold prospects in the old Blewett mining district in the Cascade Mountains west of Wenatchee, Chelan County. Contracting at the Pole

Pick property of Gold Bond Mining Company are Harold C. Lewis, Lawrence G. Jeffries, and G. D. Thorne. The adjoining Ivanhoe mine is being operated by Richard and William Hikock.

A new lower adit is being driven at the Schumaker mine in the Northport mining district, Stevens County, to gain additional depth on the high grade zinc-lead ore body discovered recently by Triton Mining Company. The tunnel, 300 feet downhill from the old adit, will be extended nearly 1,000 feet. Work is being pushed by a 10-man crew on a three-shift basis and at last report had been advanced about one-third of the distance. The work is being done by Goldfield Consolidated Mining Company and Triton under a profit-sharing partnership formed in June. Truman (Cy) Higginbotham, Colville, is general superintendent for Goldfield. Darrell Newland, Colville, heads Triton.

Wyoming

Petrochemicals Company has announced that construction has begun on a 500-ton-per-day uranium mill and related facilities in the Shirley Basin area, 60 miles south of Casper, Wyoming. Stearns-Roger Manufacturing Company of Denver has been awarded the contract for complete engineering, procurement and construction of the acid leach-solvent extraction mill, slated to cost over \$2,000,000, and scheduled for completion in April 1962. Petrochemicals Company is a partnership composed of Kerr-McGee Oil Industries, Skelly Oil Company, Getty Oil Company, and Tidewater Oil Company, and is developing its Shirley Basin properties under a five-year contract with the United States Atomic Energy Commission.

Trona replaced coal as the major product mined in Sweetwater County, Wyoming, during 1960. Output of trona from the Intermountain Chemical Company mine west of Green River last year was between 500,000 and 600,000 tons and by 1962 that figure is expected to double. Total production of coal was 242,745 tons, about five percent of the peak production figures in the 1940's.

Federal-Gas Hills Partners' uranium mill in the Gas Hills district is operating at more than its designed capacity of 522 tons per day with higher recoveries and

efficiency than anticipated, reports Nels W. Stalheim, chairman of the company. The company's exploration and development program has been very successful with reserves of "eligible" ore now available for mill operation from 1962 to 1966. Four new open pits, K, L, M, and N, are being stripped of more than 6,000,000 cubic yards of overburden in preparation for mining. M pit is being mined first. While these pits are being developed most of the mill feed comes from three other pits further away from the mill (17.5 miles).

The Colorado Fuel and Iron Company was the sole producer of iron ore in Wyoming in 1960. All ore mined at the Sunrise mine and shipped to the steel plant at Pueblo, Colorado. Shipments totaled 474,796 tons.

Stauffer Chemical Company is scheduled to start production of trona from its new mine northwest of Green River this year. This will be the second mine in the district. Intermountain Chemical Company pioneered production many years ago. In 1960, 862,879 tons of trona was mined by Intermountain.

San Francisco Chemical Company was the largest producer of phosphate rock in Wyoming in 1960. Ore was mined by open pitting along the Idaho-Wyoming border. Production totaled 136,692 tons.

Western Nuclear Corporation was the largest producer of uranium ore in Wyoming in 1960—286,647 tons—and operated the largest mine; the Frazier-Lamac open pit where 225,000 tons were mined. Globe Mining Company, a subsidiary of Union Carbide Nuclear was second largest producer with 264,536 tons mined. West Gas Hills ore was higher grade than that mined in East Gas Hills pits by Globe Mining.

Utah Construction and Mining Company's Lucky Mc division produced 210,150 tons of uranium ore in 1960 with a taxable value of \$3,053,185. This was the state's highest grade ore mined from open pits.

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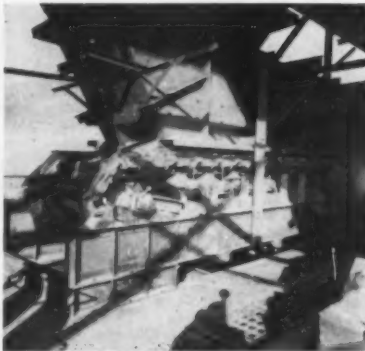
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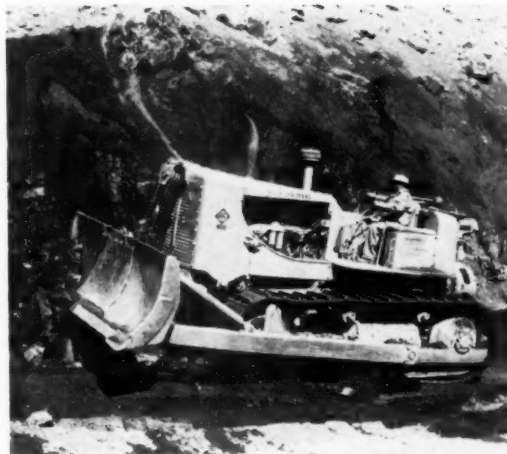
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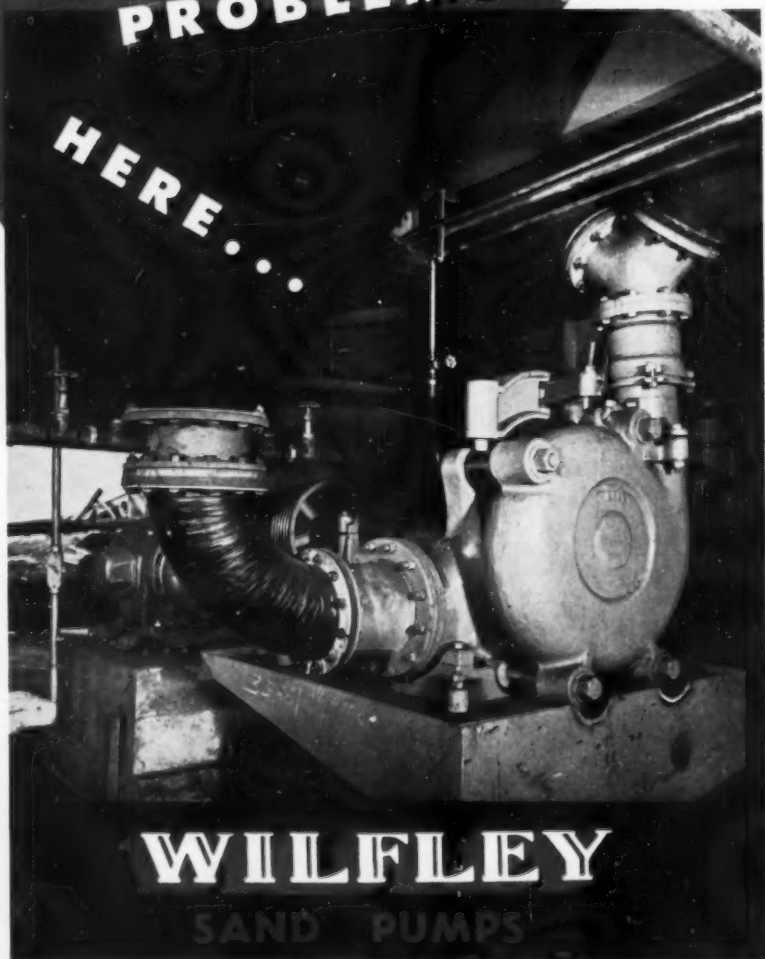
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